A Case Mix Measure for Medicare Skilled Nursing Facility Patients

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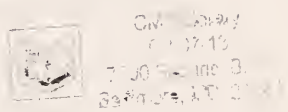

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[1] For much o udy on the faculty and staff of Rensselaer Polytechnic Instit

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St. John's Nursing Home, Rochester
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Pennsylvania:
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Forbes Center for Gerontology, Pittsburgh
Friends Hall at Fox Chase, Philadelphia
Haverford Nursing and Rehabilitation Center, Havertown
Leader Nursing and Rehabilitation Center, Bethlehem
Liberty Nursing Center, Allentown
Mayo Nursing Center, Philadelphia
Medicenter of America, Bristol
St. Francis Country House, Darby
St. John Neumann Nursing Home, Philadelphia
Willis Nursing Center, Homestead
Willowcrest Bamberger, Philadelphia

Illinois:
Alma Nelson Manor Nursing Home, Rockford
Community Convalescent Center, Naperville
Illinois Masonic Barr Pavillion, Chicago
Mercy Hospital and Medical Center, Chicago

Resurrection Nursing Pavillion, Park Ridge

Florida:
Beneva Nursing Pavillion, Sarasota
Broward Convalescent Center, Fort Lauderdale
Carol Lou Mora Care Center, Bradenton
St. Johns Nursing and Rehabilitation Center, Fort Lauderdale
Greenbriar Nursing Home, Miami
Manor Oaks, Fort Lauderdale
Morton F. Plant Rehabilitation Nursing Center, Clearwater
University Park Convalescent Center, Tampa
Venice Nursing Pavillion, Venice
Villa Maria Nursing Rehabilitation Center, North Miami

California:
Alamitos Belmont Rehabilitation Center, Long Beach
Bay Harbor Rehabilitation Center, Torrance
Beverly Manor Convalescent Hospital, Laguna Hills
Beverly Palms Rehabilitation Hospital, Los Angeles
Community Convalescent Center, Riverside
Esther Pariseau Pavillion, Burbank
French Hospital and Medical Center, San Francisco
Peninsula Rehabilitation Center, Lomita

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EXECUTIVE SUMMARY

The apparent success of the Prospective Payment System, used to pay hospitals for the care of Medicare patients, has provoked interest in developing a set of recommendations for a coordinated reimbursement methodology for Medicare patients in Skilled Nursing Facilities (SNFs). However the difficulty with most of the systems proposed is that they do not account for the differences in the costs of care seen between Medicare patients in similar facilities or even within the same facilities.

This research study focuses specifically upon the small, but important population of Medicare patients in SNFs. Its goal is to develop an accurate picture of these residents and to develop a system which could be used to classify them, particularly to determine payment. It attempts to identify groups of patients, defined on patient characteristics, so that patients in a group had relatively similar resource utilization. Such an approach has been used to develop the Diagnosis-Related Groups (DRGs) used for Medicare payment of hospitals, as well as by us to develop the Resource Utilization Groups (RUGs) for payment of nursing homes, mainly by Medicaid. However, we expected to find that Medicare patients, by the rules determining eligibility, would represent a population very different than the majority of patients in U.S. nursing homes. Thus the derivation of a classification system required primary data collection and analysis.

Data were collected in 38 nursing homes with large numbers of Medicare patients were identified in 5 states (New York, Pennsylvania, Florida, Illinois and California), states selected to provide a spectrum of Medicare reimbursement levels, staffing levels, and geographic diversity, as well as those with large numbers of facilities with high Medicare occupancies. The facilities were stratified by size, ownership, and whether they were hospital-based or free-standing. Only facilities which had the reputation with their state regulatory agency or nursing home association of providing reasonable quality of care where represented.

A combination of longitudinal and cross-sectional data collection provided both a per-case and per-diem view of these patients. Data were collected on a broad range of patient characteristics, including measures of functional capability, medical problems (including diagnoses and DRG), services and treatments received, and mental or behavior problems. We also obtained information on patients at the end of the study period: discharged, dead, or remaining at the facility but no longer on Medicare.

The second and more complex part of the data collection included the actual time spent by each type of staff (nurses and aides) in the care of individual residents. Using a variety of methodologies to assure accuracy, nursing staff self-reported the

time they spent over a 16-hour period with patients or for them (e.g., charting, consulting the admitting physician on the telephone) patients, or on other ward activities. In addition, data were collected on the utilization of physical, occupational and speech therapies, social work, etc. over a one-week period. From these data we constructed daily costs for these elements of caring for Medicare patients.

These data demonstrate that the SNF Medicare population is significantly different than the non-Medicare population in SNFs. It follows from the wide difference in admissions reason--restoration for most Medicare patients and few others -- that the Medicare population generally has more serious medical problems. Also, with shorter stays in nursing homes, the lower frequencies of mental problems related to long-term care (e.g., regression, hallucination, wandering) was expected.

The initial work focused on developing a system to explain per-diem costs, in contrast to per-case costs such as those used in the DRG system. When each of the variables describing patients in the database is evaluated as a potential individual item upon which to differentiate patients, identifiers of the facility, region, and state were those most descriptive of resource consumption. The care given to patients is thus strongly driven by the care patterns of facilities and regions, and state norms or regulations.

In the development of a classification system for Medicare patients we considered carefully various other systems that have been proposed, including the use of diagnoses, DRGs, Activities of Daily Living (ADL) scores, and other composite systems. We considered as well the system we developed for Medicaid payment to New York State nursing homes: the Resource Utilization Groups (RUG-II) system.

Diagnosis, by itself, was not especially useful in predicting resource use. First, as coded in the ICD-9-CM system, there are too many diagnoses are to provide a clinically sensible categorization of patients. DRGs had similarly low explanations. On the strength of these results, we determined that diagnoses or DRGs alone cannot be effective in explaining nursing home resources for Medicare patients. As we had found with other nursing home populations, it is functional characteristics and particular medical conditions (and, at times, particular individual diagnoses) rather than the general acute care diagnosis that drives resource use in nursing homes.

In contrast, the RUG-II system was fairly adept at explaining resource use. It required, however, modification to explain better the large numbers of very different rehabilitation patients seen in the Medicare population.

This report details three systems for classifying Medicare SNF patients. The recommended system, Resource Utilization Groups

- Title 18 (RUG-T18) is a modification of the RUG-II system, adding additional groups to differentiate rehabilitation patients. Patients are first classified into five general types: Heavy Rehabilitation, Special Care (those with severe medical problems), Clinically Complex (those with medical conditions require significant care), Severe Behavioral Problems, and the rest, with Reduced Physical Functioning. The Rehabilitation group is split by the number of therapies (physical, occupational, and speech) they received intensively. These groups, along with a score of Activities of Daily Living based upon the ADLs of toileting, eating, and transfer, result in a total of twenty RUG-T18 groups. The RUG-T18 system explains 55.5% of the total (nursing plus ancillary) per-diem costs of care.

The RUG-T18 system uses a measures of resource consumption--auxiliary time of at least 30 minutes per day and the number of auxiliary treatment services (PT, OT, and Speech Therapy) provided to a patient for more than 30 minutes per day -- as patient characteristics to explain resource use. Although we feel this use is justified and, in fact, beneficial, we also developed two alternative systems which are in our view is inferior, but which represent a more "purist" approach to patient classification. The RUG-T18A system, which substitutes whether a patient had a Cerebrovascular Accident (CVA) for the count of therapies in the RUG-T18 system, achieves 28.71% variance explanation for total cost. A third and more experimental approach, a "Hierarchy of Expected Rehabilitation" (RUG-HER), was also developed. It attempts to predict those patients who will receive rehabilitation, and a result has lower (34.5%) explanation of resource use. However, this system may be of use to policy analysts interested in contrasting populations in different states or under different patterns of care.

We were unsuccessful in developing a classification system for episodes (cases) of care. First, we could discern little pattern to resource use over a patients stay, even by type of patient. The stage of the stay played only a small role: patients in their first two weeks of stay tended to be slightly higher in cost than patients later in their stay. In the absence of a strong pattern, it was not possible to construct in a sophisticated manner episode-based cost measures to use in developing a per-case classification system. Second, the RUG-T18 system and others considered did not perform well in explaining a coarse measure of cost obtained by multiplying the per-diem cost by the length of stay.

Finally we discuss several issues involved with developing a payment system for Medicare.

A Case Mix Measure for Medicare Skilled Nursing Facility Patients

I. Introduction

Coincident with pressures to cut governmental spending in all sectors, the federal government's expenditures for nursing home care has been expanding rapidly. Nursing home expenditures now comprise the fastest rising component of personal health care expenditures and have risen over the past several years at a rate which is more than double that of the consumer price index.(U. S. Senate Select Committee on Aging, 1984) Between 1965 and 1984, the public share of nursing home costs soared from $0.7 to $12.1 billion. At the end of this period, public expenditures represented 48.0% of the national nursing home costs and over 10% of public spending on all personal health care. Nursing home care absorbed 68% of all Medicaid expenditures for the elderly. In 1984, Medicare payments to skilled nursing facilities (SNFs) totalled $539 million, representing 0.9% of all Medicare expenditures, and 2.1% of nursing home reimbursements. (U.S. Senate Special Committee on Aging, 1986; Schieber et al., 1986).

We and others (e.g., Scanlon et al. 1980) have proposed that these escalating costs make it essential that methods be developed which ensure that long-term care resources, which will of necessity either become increasingly scarce or at least bear the severe scrutiny of fiscal urgency, be properly matched with those most in need. In an earlier report we stated:

> The proper match between patient needs and resources can never be absolute. This match requires a careful understanding of the factors which influence the relative care needs of a group of patients and the resources available to care for this group, their cost, and the reimbursement available to provide them. A proper reimbursement system will recognize varying care needs of patients and promote the provision of the resources appropriate to these needs.(Fries and Cooney, 1983)

Most public systems for reimbursing nursing homes do not recognize the variations seen between patients, and thus can be expected either to over-compensate facilities at public expense, or to pay less than the true cost of providing adequate care for individual patients. In either case, such systems encourage facilities to select patients with the least care needs. This causes problems of access to care for "heavy care" patients in acute hospitals awaiting placement. In addition, there is no incentive for a facility to return patients to home or to less care-intensive facilities when they are ready.

In the last few years, these issues have developed considerable interest in "case mix" reimbursement systems, which recognize the differences in the costs of caring for individual patients.

Such systems appear to offer the best compromise between appropriate resources for each patient's needs and administration feasibility. Initially, efforts focused on the most expensive hospital sector, although we and others have more recently designed such systems for nursing homes. Case mix reimbursement systems, properly derived, appear to be effective in providing appropriate incentives and equitable reimbursement in long-term care. They do, however, require an accurate, practical, and reproducible measure of relative care needs of the patient population.

To date, Medicare has not differentiated patients in nursing home settings (SNFs), and has reimbursed either at facility per-diem allowable costs or at a "ceiling" of 112% of the national average of per-diem costs of freestanding SNF costs, with adjustments for hospital-based facilities, location, wage factors, etc.(HCFA Report to Congress, 1985) In the hospital sector, however, Medicare has lead the way by developing a price-based Prospective Payment System (PPS) incorporating case mix. Since October 1, 1983, hospitals are reimbursed a fixed sum for all care in an episode of illness, where the episodes (cases) are defined by the clusters of the Diagnosis-Related Groups (DRGs). This new system has had significant impact upon the operations of the hospital sector (see, e.g., Guterman and Dobson, 1986).

The apparent success of PPS has provoked interest in developing a set of recommendations for a coordinated reimbursement methodology for Medicare SNF patients. The systems being suggested include prospective payment for SNF care, with these payments either constant over all facilities (after adjustment for wage differentials) or differentiated on the basis of the urban/rural location of the facility and perhaps whether it is hospital-based. The difficulty with these systems is that they do not account for the differences in the costs of care seen between Medicare patients in similar facilities or even within the same facilities.

Others have therefore suggested payment systems that differentiate payment for individual patients, in particular based on diagnosis, perhaps as an add-on to the Medicare acute care (DRG-based) rates paid to hospitals. Such a system based on diagnosis may be an initial step in differentiating patients, but there is contradictory evidence that actual resource consumption by Medicare patients in SNFs is associated with diagnosis (see Section IV.B.2). Although it would be advantageous to "bundle" all payments to the hospital, removing incentives for inappropriately early discharge, these advantages can be obtained even if the payment for the post-hospital stay is based on other case-mix measures.

Unfortunately, no case-mix measurement systems have been derived or proven appropriate for the Medicare population. A 1983 study commissioned by the HCFA Office of Legislation and Policy documented that:

> [the] review uncovered no studies that focused on the Medicare SNF population. Consequently, [the study] objective was to report on case mix measures used for long- term care population in general and to address issues that should be considered in developing case mix adjusted reimbursement methodologies. (Stassen and Bishop, 1983, p. ii)

In fact, as these authors report, there is little known of the differences between Medicare and non-Medicare patients. Only a recent study by Shaughnessy et al. (1985) focuses on this issue. They assessed 756 patients from 26 nursing homes in six states, and found differences when contrasting Medicare patients with other residents on the basis of patient characteristics, diagnosis, clinical signs, etc. (see also Liu and Mossey, 1980, and the excellent reviews in Schieber et al. 1986 and Liu et al. 1986.).

In addition to its potential use for reimbursement, an understanding of case mix for Medicare patients will enable more accurate assessment of the impact that the implementation of the PPS system has had on nursing homes. It has been suggested that earlier hospital discharge is placing sicker and more disabled Medicare patients in hospitals. With a heavier case mix in the nation's nursing homes, it would be appropriate that SNF payments increase. Concurrently, total Medicare expenditures (hospitals plus nursing homes) should decrease as the result of increased patient care in the lesser expensive environment. Understanding the magnitude of these shifts in costs requires accurate and valid measurement of case mix.

Other applications for a case-mix measure include the comparison of long-term care facilities, facility operations management (including staffing), evaluation of care plans, and as part of the assurance of quality of care. Without a measure to adjust the cost or performance of a facility for the patients it cares for, it appears fruitless to attempt to understand which efficiencies or inefficiencies can be attributed to the production of services, cost, or quality of care.(Fries and Cooney, 1983, Cooney and Fries, 1985).

In July, 1984, we commenced on the current study for the HCFA Office of Research and Demonstrations to develop a patient classification and case mix measurement system for Medicare patients in Skilled Nursing Facilities. This report details the goals, methodologies and findings of this study.

II. Methodological Approach

The development of a Medicare SNF case-mix reimbursement system requires three basic developmental steps:

- Develop a patient classification system to classify Medicare SNF patients.

- Determine the patterns of resource consumption associated with caring for each class of patient.

- Design a reimbursement or payment methodology which incorporated the patient classification system and the resource consumption patterns.

This project has focused on these first two steps, although in a later section we make several recommendations concerning the latter step. A effective case-mix reimbursement system must be constructed from an well defined case-mix system which accurately predicts resource use and a well articulated reimbursement methodology which addresses the identified goals and incentives. These two development activities are neither totally coincidental nor totally independent. Although the development of a case mix system is more scientific in nature, contrasting with the more political process of deriving a reimbursement system, it nevertheless requires in its design full cognizance of the role it plays in determining payment. Thus, certain variables and constructs that might be employed for the more simple task of understanding resource consumption are not appropriate for reimbursement. (Ref: Schneider et al. 1983, 1985a; Smits, 1984) We discuss these issues in Section III.B.2.

II.A Overview of Approach

The development of a case mix measurement is based on the concept of identifying the specific "products" of long-term care institutions. The product of a health care facility is the set of services provided to a patient and the resources used as part of the caring process. While each individual patient admitted to an institution is unique, he or she has certain mental, physical, and medical characteristics in common with other patients that determine the level of services received. If classes of patients with the same characteristics and similar processes of care can be identified, then the framework within which to aggregate patients into case types is established. Such a classification system would provide the structure for the measurement of case mix.

We already have successfully employed this approach in deriving case mix measures for the general LTC nursing home population. (Fries and Cooney 1983, 1985; Schneider et al. 1984). Discussed in Section III.B.4 are the derivations of the Resource Utilization Groups (RUG) and the RUG-II system in use in New York State for Medicaid reimbursement of nursing homes. This project in part evaluates the effectiveness of these systems in predicting

resource use by Medicare patients in SNF nursing homes as well as considers the appropriateness of alternative approaches to developing patient groups.

Once the classes of Medicare patients have been determined, the second step develops relative cost for these groups by elaborating the LTC resources consumed by its members. Technical problems include the balancing of the costs for different types of resources employed in the care process.

The final of these three steps, the development of a payment methodology, is beyond the scope of this study, for, as we previously stated, the design of a reimbursement methodology must be closely tied to the goals and incentives of that system; these for Medicare have not as yet been fully articulated. Nevertheless, many of the operational problems inherent in a case mix payment system are related to how the patient classification system and resource consumption patterns are defined. Thus, the classification methodology developed in this demonstration is designed with foresight to potential operational problems of a reimbursement system.

The issues pertaining to each research phase, discussed in following sections, are summarized as follows:

Patient Classification: The major issue in implementing a system to classify patients is one of reliability. Payment to a facility will be based in part on an assessment of the patient's condition. The patient classification resulting from the assessment must exhibit inter-rater reliability (for auditing purposes) and it should be difficult to "game" or manipulate.

Resource Consumption Patterns: The relationship between the patient classes and resources required to care for the patients largely involves a validity issue. If the patients in a given class exhibited a large degree of variability with respect to resources required, the system would have little validity. Thus, while there are many ways to define classes of people who utilize different levels of resources (e.g., sick people versus well people, old versus young), perceptions of validity will relate not only to the fact that there are differences in the means between classes, but more importantly, to the amount of variability within a class.

Payment Methodology: The particular choice of payment system eventually developed by HCFA to incorporate the case mix measures largely determines the inherent incentives in the system. This point is important because there are multiple dangers inherently in case mix reimbursement, dangers which can be controlled or minimized under some case mix approaches and which will be unmanageable in other approaches. The danger stems from the following observations regarding the basic feature of case mix reimbursement:

- A patient in poor condition will lead to higher reimbursement than a patient in good condition. This fact holds true through the entire spectrum of a patient's health status.

- Not providing care for a patient will be cheaper than providing necessary care and will lead to a deterioration of the patient. Thus, surveillance of quality care becomes a more critical activity.

The potential opportunities inherent in case mix reimbursement are equally challenging to consider. It should be noted that case mix reimbursement can set the stage for fundamental improvements in the structure of long-term care systems:

- The current financial disincentives for a facility to admit sicker patients would be removed, thus the hospital backlog would decline.

- There would be no financial incentive for a facility to admit or retain less sick patients (patients who may be more appropriately served by an expanding home care system).

- Cost based reimbursement would be less necessary as reimbursement would already account for a major difference between providers' costs -- case mix. Through the payment process, attention could be focused on the effectiveness and efficiency of providers, how differing cost structures and patterns of care related to quality of care and outcomes. Issues in developing payment systems could then better focus on other differences in cost structure and the appropriateness of differing care patterns and their effect on outcomes.

- Incentives for rehabilitation and better outcomes for patients could be built into the system.

II.B Approach to Developing a Case Mix Measure - Resource Utilization Groups

There are two generic approaches to developing case mix measures. The first approach, is to develop directly a case mix index for a facility, rather than a case mix index of the patients in a facility. A variety of studies have attempted to explain the factors affecting cost by focusing on institutional variables such as type of ownership, nature of care given, number of beds, occupancy, and location and often using regression analysis to derive the index. Eleven such studies have been reviewed by Birnbaum (1981). More recent work, reported by Liu et al. (1986) and Sulvetta and Holahan (1986) indicates that the percentage of occupancy represented by Medicare patients is a good predictor of nursing homes cost.

We have avoided the facility-related approach for a variety of reasons. First, such a approach does not recognize that it is the care needs of individual patients that is the major determinant of cost and thus, does not provide inherent and explicit incentives to accept heavier care patients. The example given above, of facility payor mix as a predictor of cost and thereby a case mix surrogate, is representative of this type of problem. Second, many of the measures that might be used are those cost related items that might well be controlled. Thus, their inclusion in a rate setting formula, is a sophisticated, indirect return to cost reimbursement rather than a prospective rate setting approach. Third, facilities would still have to cope with differences in the intensity of care required by their patients, and these differences across time or across facilities would not be recognized outside of those correlated with facility characteristics.

The second generic approach to define case mix solves the problem by examining directly the patients in a facility. The logic for this approach is based in the industrial engineering concept of the "product" of a firm. If the types of patients in a facility or the level of their needs can be specified, then a facility's case mix is the amalgamation of these measures for all its residents. Examples of these approaches are well documented in the report by Stassen and Bishop (1983).

There are six different patient-centered approaches to measuring case mix in a facility. These methods are:

- Case management - Actual or normative care plans are individually costed out. This approach, a type of cost-based reimbursement, is that used in the Ohio and West Virginia Medicaid systems.

- Case mix based on several factors - A few factors are considered and used to derive all the classes in the system. An example is the Diagnosis Related Groups (DRGs) for acute care in which diagnosis, procedure, and age are the determining factors (Fetter et al., 1980, 1981), and the Maryland Medicaid nursing home reimbursement system. The average cost of each group is determined, and used as a weight applied to the number of patients in that group.

- Case mix clusters - Similar to "case mix based on several factors" except that many different factors are used to derive the classes. Examples are the RUG classification system and the patient classification system used in the Minnesota Medicaid nursing home reimbursement system. Average costs are determined as above.

- Diagnosis - Common diagnoses for the elderly are selected and used as the case mix classification. Note that if this were the best approach, it would naturally fall out of either of the approaches immediately above. Such a system

would link well with the DRGs used in Medicare PPS reimbursement of hospitals. We are not currently aware of any such system for nursing homes.

- Numerical assessment - Each patient is assessed and points are assigned based on numerical values for each factor, usually with more factors than the previous three types of systems. The index scores for each patient in a facility are averaged to develop a facility case mix index. Such systems do not handle well the complex interactions between patient characteristics, and their effect on predicting resource consumption. Systems of this type include the Illinois system and systems developed by Flagle (1977), Caviaola and Young (1980) and McCaffree et al. (1976, 1979), the last of which is in use in the State of Washington for Medicaid nursing home reimbursement.

- Prognosis - Payment would be based on the patient's expected prognosis. Additional incentives could be included if the actual outcome is better than the expected outcome (e.g., discharge to home for a patient that would normally have a low probability of this out outcome). A system of this type has been suggested by Kane (1983).

Each case mix approach offers advantages and disadvantages as a methodology for case mix reimbursement. Their characteristics with respect to (1) development effort; (2) administration; (3) reliability, validity; (4) monitoring, auditing; (5) cost containment; and (6) inherent incentives are indicated in Table 1.

Two systems, case management and numerical assessment, offer few advantages in a comparison with the other approaches. Of the remaining approaches, a case mix index is easiest to develop and operate. However, it fares poorly with respect to cost containment and incentives. The approach based solely on diagnosis has many good attributes but with few groups and a spectrum of patients in each, it is unattractive for its low validity, high variability, and incentives for facilities to "pick and choose" patients within a diagnosis. An approach based upon prognosis is currently believed to be beyond the state of the art (although prognosis measures could be built into a cluster system).

The other three systems compare well with respect to the cost and incentives criteria. Of the three systems, the cluster approach is superior to the approach of "case mix based on several factors." This latter approach works well for acute care since diagnoses and treatment procedures dominate the care process. It can also be noted that the "case mix based on several factors" is essentially a subset of the cluster approach. Thus, any development of the cluster approach could include "case mix base on several factors" as a special case. It should also be noted that, to the extent diagnosis plays a significant role in patient

Table 1

SUMMARY OF MERITS OF VARIOUS CASE MIX APPROACHES

	DEVELOPMENT	ADMINISTRATION	RELIABILITY VALIDITY	MONITORING AUDITING	COST CONTAINMENT	INHERENT INCENTIVES
Facility-based Measure						
Case Mix Index	Moderate	Easy	Fair	Easy	Fair	Poor to Mixed
Patient-based Measure						
Case Management	Extremely Difficult	Most Difficult	Fair	Very Difficult	Poor	Mixed
Case Mix on Several Factors	Very Difficult	Fair	Problematic	Easy	Good	Good
Clusters	Very Difficult	Fair	Fair	Easy	Good	Excellent
Diagnosis	Moderately Difficult	Fair	Low Validity	Easy	Good	Poor to Mixed
Numerical Assessment	Moderately Difficult	Easy	Poor	Difficult	Poor	Poor
Prognosis	Beyond State of the Art	Moderately Difficult	Poor	Very Difficult	Good	Excellent

care for Medicare LTC patients, it will fall out of the cluster analysis and will define some of the patient classes.

The strengths of the cluster approach and its subsumation of some of the competitive approaches, make it the superior overall framework for developing a case mix classification. These strengths include the following:

- A limited number of clusters tend to make the system manageable to develop, control, monitor, administer, and update.

- The system is easier to monitor and audit. Since the cluster categories encompass many types of descriptors, it is somewhat more difficult to manipulate a patient's assessment to classify a patient in a different reimbursement rate category.

- The cluster approach is intuitively appealing, especially if the clusters are based not only on statistical evidence but also the reasonableness of the groupings. Providers maintain that discrete and homogeneous groups of patients naturally can be differentiated in facilities.

- Most of the inherent incentives for allowing a patient's condition to decline are missing from the cluster approach because only a small number of discrete clusters will be used. Other systems tend to create excessively responsive indicators, e.g., a dollar-for-dollar exchange rate for increasingly morbid scores in a numerical assessment system.

- A case mix cluster approach can be incorporated well into a prospective system of payment.

For these reasons, the initial development of a case mix measure for general LTC nursing home patients was developed using the cluster approach. The initial pilot version of Resource Utilization Groups (RUGs) was developed by the principal investigator while at Yale University; this system was derived in a manner similar to that used to create the DRGs. Using patient characteristics and estimates of the relative time spent on caring for a total of 1,469 Connecticut nursing home patients, a system of nine RUGs was derived. Since then, a major redevelopment has been performed by the authors as part of the design of a prospective case mix based reimbursement system for nursing homes in New York State, under a HCFA grant and funding by New York State. The three year grant began in August 1983 and the new reimbursement system has been in operation since January 1, 1986. Utilizing data on 3,427 patients in New York State nursing homes, with staff-measured nursing and therapy times, we derived a 16 category system named Resource Utilization Groups - Version II (RUG-II).

Recent results of an independent project to develop a case mix system for Medicaid patients in Texas show the RUG-II system to be effective there as well (Coleman, 1987). It should be noted that the Texas long-term care system is considerably different than that in New York State on the basis of staffing and reimbursement levels.

The new RUG-II system creates patients groups utilizing a much broader set of criteria than those used in previous cluster method approaches. We discuss later these criteria, employed as well in the current methodology to develop a classification system for Medicare SNF patients.

II.C Potential Problems with Applying Existing Long-Term Care Case-Mix Measures to Medicare Patients

All of the systems described in the previous section focus generally on the long-term care patient. However, Medicare patients represent only a small portion of that population. In developing the RUG-II system, we found that only 3.5% of the sample were Medicare, greatly limiting analysis. (This percentage was higher than the percent of patients in SNF either in New York or nationally -- both at 3% -- as the New York State study "oversampled" heavy care patients, including those on Medicare.) Similarly, most other systems do not analyze specifically the Medicare population. We know of only three studies which have focused specifically on the Medicare patient (Liu and Mossey, 1980; Shaughnessy et al., 1985; and Cotterill, 1986).

Furthermore, there is reason to believe that Medicare recipients are significantly different than their nursing home cohorts. Medicare regulations stipulate that patients are eligible if they are in need of skilled nursing care as a consequence of an acute episode of illness. This has two implications. First, these patients are in nursing homes for specific services, usually recuperative or rehabilitative. In this, they differ from the majority for whom the nursing home provides principally maintenance. Second, these patients are usually shorter-stay patients, although some proportion stay on in nursing homes as long-stayers without Medicare funding. As with other "short-stayers" the resources employed in their care can be expected to be different on these grounds alone. For example, the nursing services involved with admission and discharge are proportionally greater for patients who stay in the facility a short length of time.

Thus we believe that many Medicare patients are quite different from Medicaid/private pay patients in that many Medicare patients have: (1) a short-term stay (partly due to Medicare payment limitations and partly due to the patient conditions covered by Medicare); (2) are more likely to receive extensive rehabilitation care; (3) are more likely to have a brief convalescent visit for post hospital care; (4) are more likely to be discharged home; (5) are more likely to have specific conditions

causing their stay (e.g., fractured hip, stroke) rather than generalized functional problems; and (6) are more likely to be receiving specific terminal care (e.g., cancer).

Keeler et al. (1981) examined the lengths of stay of discharged patients in the 1977 National Nursing Home Survey, and designated two types of patients: long-stay and short-stay nursing home residents. When these two types of patients were contrasted, they were found to be significantly different. Long-stay patients rarely were discharged home, more likely left the nursing home for the hospital and were less likely to be married. These patients were more likely to manifest mental disorders and senility. Short-stay patients were usually those with fractures or cancer. Medicare is, as they point out, "almost never the primary source of support of long-stayers" and they estimate that in their sample 18% of the discharges were for Medicare patients. This is consonant with the high proportion of fractures and cancer, indicating restorative convalescence and terminal care, all covered by Medicare. It should be noted that the 18% Medicare discharges is not unusually high, as this represents a longitudinal sample of patients. They correct this to a 2% proportion of residents (cross-sectional) who are supported by Medicare; the short-stay of these patients inflates their contribution to the number of discharges. Finally, they state that the average charge for the Medicare subgroup of short-stay patients is $1300, about twice the charge for long-stayers.

Other evidence that Medicare patients are different than other nursing home patients comes from work reported by Shaughnessy et al. (1985) who analyzed a sample of 756 patients in 26 nursing homes. Medicare patients were less functionally disabled, had higher rehabilitation potential, and had fewer traditional long-term care problems such as sensory impairments, incontinence, etc. Again, it appears that the short-stay, temporary placement patients, constituting the bulk of Medicare patients, are different than the long-stay, permanent placement patients, most of whom are supported by Medicaid.

Similarly, there is evidence that patterns of resource use by Medicare patients in SNFs is quite different than that of these same patients in acute care settings. In the acute care setting, we and others have found that systems based on diagnosis, and the DRGs in particular, are explanatory of resources used. However, for patients in nursing homes (mainly Medicaid), most researchers do not find diagnosis an important discriminator, including Caviaola and Young (1980) and McCaffree (1976, 1979). Cameron (1985) found that only the presence of neurological problems is a distinguishing factor of LTC patients. Our RUG-II system identifies a few, very specific and very severe diagnoses as predictive of resource consumption, but much of the variability seen in the resource use of Medicaid patients is explained by functional problems, as summarized in an Index of Activities of Daily Living. Most recently, Cotterill (1986) considered both per-diem and per-case indexes for the 66 most common DRGs based on the SNF

admission diagnosis. Using the 1980 Medicare Cost Report data for 5118 SNFs, he found that the DRGs were not effective in predicting nursing home charges (as a proxy for costs).

The above results support the hypothesis that in fact Medicare SNF patients are different than other nursing home patients and than Medicare patients in hospitals. Notwithstanding, this study is one of the first to focus attention particularly on their characteristics.

While we expect that Medicare and Medicaid patients are substantially different population, this does no preclude that the RUG-II system is useful for classifying Medicare SNF patients. First, the differences in the populations seen as a whole may be different simply due to differences in the frequency of patient types. Alternately stated, we hypothesized that the same types of patients appear in the two populations; for each type of Medicare patients we find a cohort of similar Medicaid patients. This reasoning is strengthened by two observations. First, some Medicare patients remain in nursing homes and become Medicaid-funded, with characteristics quite similar to the average long-stay nursing home patient. Second, with the special effort made in the NYS RUG-II project to collect sufficient data to classify rehabilitation and heavy care need patients, we did collect data on and analyze 80 Medicare patients as well as an undetermined number of post-hospital patients who could be expected to be similar to Medicare patients. Thus, the RUG-II represents a potential starting point for developing a Medicare SNF patient classification system.

The work to date made it evident that in order to determine a case mix measure for Medicare SNF patients, it was necessary to undertake a new data collection effort which focused specifically on these residents. We describe in the following sections our approach to data collection and the results of their analysis.

III. Methodology

Many of the methods used in this study replicate those developed in two previous studies: the New York State Long-Term Care Case Mix Reimbursement Project (NYSCMRP) (Schneider et al. 1983, 1985b; Fries et al. 1983; Foley et al. 1984) and, to a lesser degree, the original Yale Resource Utilization Group project (Fries and Cooney, 1983). We report here the major steps of the current study and highlight differences from previous studies. Additional detail is also available in the appendices, including instruments used and the data collection training manual.

III.A Data collection

The development of a patient classification system for Medicare SNF patients required the collection of a national data base to contain information on patient characteristics and their resource use. Initially we planned to involve facilities from a few states and a sample size of 1000. However, after consultation with HCFA and the national nursing home organizations, and on our own recommendation, the final design included over 3300 patients in five states.

The necessity to develop patient-specific measures of resource consumption precluded a broad survey methodology for collecting data, since these data would not be easily available. Also, the methodologies for nursing time measurement we designed initially for the NYSCMRP required full nursing units to be involved so that all nursing time for a shift is assigned either directly to patient care or indirectly to the operations of a unit. These restrictions had two implications for our data collection:

- a limited number of facilities would be involved with the data collection

- the facilities chosen would need to have nursing units which had high percentages of Medicare patients so that a data collection effort on a unit would yield significant numbers of Medicare patients.

Focusing on facilities and units with higher percentages of Medicare patients has a potential bias which could not be avoided. However, first, these units do provide a large percentage of the Medicare SNF days. The final sample size collected represents close to 10% of Medicare patients in SNFs on a given day (using projected data from the HCFA Report to Congress, 1985). Second, there is no evidence that these patients are different in type from those in units or facilities with lower percentages of Medicare residents. Schieber et al. (1986) reports that in 1980, 5000 nursing homes were certified for Medicare but less than 400 facilities provided 40 percent of the total Medicare days. It is expected, however, that by taking this focus our sample over-

represents rehabilitation care, units and patients; care should therefore be taken in extrapolating from these data to national statistics. Also by sampling large numbers of patients in relatively few facilities, we have augmented the possibility of random bias.

III.A.1 State and Facility Selection

The sample was designed to provide a spectrum of Medicare patients, rather than be specifically balanced to permit facility-level analysis, for example, in comparing hospital-based and freestanding facilities.

The sample was drawn from a total of 40 facilities in five states. The states chosen were California, Florida, Illinois, Pennsylvania, and New York. This selection was made to balance several criteria, most based on 1984 data (Cornelius, 1985):

- Large numbers of facilities with average Medicare census of more than 16 patients reported in 1982. Florida had the most such facilities (51), while Illinois was third (36). Also, Florida had the second highest statewide average Medicare bed utilization (5.7%), Pennsylvania the third highest (3.1%); New York and California were more moderate (2.1%).

- Reimbursement levels. Illinois, Pennsylvania and Florida Medicare reimbursements per day ($44, $37 and $35 in 1982, respectively) are below average, while New York at $48 is close to the average and California ($58) is above average.

- Staffing levels. New York and Pennsylvania have high numbers of beds per registered nurse (5.5 and 7.8), while California, Florida, and Illinois were some of the lowest staffed (9.0, 12.0, 13.7).

- Geographic diversity.

As well, the states were chosen to minimize overlap with facilities involved in Shaughnessy's (1985) several studies and to include those with strong state associations of the American Association of Homes for the Aging (AAHA) and the American Health Care Association (AHCA), who could be helpful in enlisting the assistance of facilities.

Once these five states were chosen, we were aided by the states' regulatory departments and nursing home associations to identify SNFs that met the following criteria:

- Had units with more than 50% of their patients (or more than 25 patients) on Medicare

- Met minimal quality standards, as recommended by the states' quality assurance bureaus and nursing home associations

- Were stratified by size, ownership (for-profit and not-for-profit), and hospital-based/freestanding

- Clustered in 1-2 geographic areas of the state (to reduce travel costs to the project).

We set a goal of 40 facilities, and recruited 46 facilities for data collection. Again, the state nursing home associations were extremely helpful in the enlistment. As expected, for a variety of reasons, including inadequate facility manpower, organizational problems, and significant drops in Medicare census, seven facilities withdrew before data were collected. One more facility dropped out during the data collection and did not provide usable data. Thus we report on data from a total of 38 facilities.

III.A.2 Data Collection Methodology

The derivation of a patient classification system required two types of data about individual patients: an assessment of broad spectrum of patient characteristics and measures of the resources employed in caring for these patients. As well, data about the relative costs of each type of resource were needed to accumulate different types of resources into a common cost measure.

Patient-related data were collected within selected units of the sample SNFs by facility staff. As in the New York State Project, we decided to have staff of the facilities themselves collect the data, as they would best understand the characteristics of their own patients and the data collection of staff time would be less affected by the presence of outsiders. Using facility staff also allowed us to increase the sample size significantly. To offset potential problems of decentralized data collection we again put in place procedures to assure reliability and validity. These included:

- data collection instruments which were careful designed to include important clarifications and descriptors on the instruments themselves, and which could be easily keypunched. Terms such as "generally" or "always" are clearly defined, and the time periods involved are carefully detailed (e.g., "within the last 7 days (or since admission if admission is within the last 7 days ...."). A total of 13 different data forms were developed, reviewed, and tested.

- detailed procedures for facility staff involved with the data collection that lead them through all phases of the project, including pretests and data collection, verification and audit.

- a training manual covering all aspects of the data collection procedure, organized by sections focusing on each stage/procedures. Included in this 112 page document were descriptions of the study procedures, and goals, roles for each person involved, explanations and examples of assessment questions, common diagnoses and abbreviations, suggested sources of data, schedules, etc.

- training of facility staff involved, in nine training sessions the project ran in the 5 states. These sessions covered all phases of the collection effort, discussed technical issues of patient assessments and methodologies for assuring accurate measurement of resource use. Two to four staff members of each facility involved attended these sessions, depending upon how many nursing units were involved with the study.

- pretests of each major phase of the data collection both in the design phase by project staff and within each facility by facility staff, to "shake down" the procedures.

- a senior nurse in each facility designated as the "Data Quality Reviewer," with explicit responsibilities to oversee the collection, perform reliability checks, and review the data.

- auditing of all data by facility staff using a computer-generated "turnaround document" which detailed all data elements and highlighted missing or incorrect data for correction.

- "case mix nurses," Registered Nurses on the project responsible for the quality of the data accumulated. These project staff members participated in the training meetings and visited each collection site after the training meeting to review procedures and after the first wave of data collection (with the turnaround document) to assure appropriate adherence to study protocols and accurate data. These nurses then performed a 100% manual audit of the data, visiting or telephoning the facilities to resolve any data problems. Based on their opinions, a small number of inaccurate assessments were eliminated from the database.

- a 24-hour "hotline" for facilities to call during the data collection effort with any problems, with responses logged in the project office for consistency across data collection sites.

III.A.3 Data Collection Framework

Given that there are relatively few Medicare patients in a facility at any given point in time, and that Medicare patients may be characterized by significant and relatively rapid changes

as compared with the fairly stable long-term Medicaid population, we considered a data collection frame with a longitudinal component as well as the expected cross-sectional aspect. The design included three "waves" of data collection in each facility. Each wave, occurring on a rigid schedule after an assigned starting date for each facility, included assessment of both patient characteristics and resource consumption. Thus Medicare patients could be assessed from one to three times. This longitudinal view is used in evaluating patterns of care over time and the development of a case-based classification system (see Sections IV.F and IV.G). Except for these analyses, each assessment served as the unit of observation.

The timing of the waves and the yield of number of patients for each Medicare bed represented critical design issues. We developed a computer simulation model of the data collection process, using a model programmed in the General Purpose Simulation System (GPSS) package (Gordon, 1975) to project the outcome of various schedules of the three waves in the numbers of patients assessed and the number with more than one assessment. These analyses lead us to conclude that after the first assessment (denoted Day 1 for each facility) it would be best to evaluate patients on Day 7 and 35. We predicted, based on the model, that for each Medicare bed we would see 1.6 patients over the three waves, and 1.33 assessments per patient would be performed. These results later turned out to be remarkably close to the actual realizations, especially given the uncertainty of the distribution of length of stay of Medicare patients. We believe that we are the first to employ simulation in this manner to design a sampling plan.

The staff time measurement procedures, described below, required the involvement of full nursing units, and thus staff times were obtained for both Medicare and all other patients on these units. It seemed appropriate, therefore, to save these data and collection patient characteristics for non-Medicare patients on these same units. Thus, on the second wave of data collection in each facility, all non-Medicare patients were also assessed. The analysis of this portion of the database is considered in Section IV.H.

In the following we give an overview of the data collection methods. Additional details can be found in the project Training Manual.(Appendix C)

<u>Patient characteristics</u>. The assessment of patients was performed on a broad spectrum of characteristics. The questions assembled included those we had included in the NYSCMRP, improvements or additional questions derived from that experience, additional medical and physical characteristics, and questions suggested by the clinicians associated with the project. We eliminated those characteristics which either: 1) could not be used in any reimbursement system, because they could not be reliably assessed, could be easily "gamed," or were otherwise

inappropriate (e.g., race/ethnicity); or 2) had been shown in our previous studies to provide no insight into resource use and for which no clinical evidence could be developed that would indicate that this result would be different for the Medicare population (e.g., number of medications). The dimensions of the assessments included:

Demographic: age, sex, etc.
Fiscal: funding, time since admission
Mental: learning ability, disoriented, etc.
Social/behavioral: aggression, regression, etc.
Functional: Activities of Daily Living
Medical: vision, hearing, medications, etc.
Medical conditions: hemiplegia, decubiti, edema, etc.
Diagnosis (current major) and hospital DRG
Treatments and services

In total, 122 items were assessed for each patient. Compared with the instrument used in the RUG-II development, significantly more detailed information was collected on medical problems and services. In other areas, such as the assessment of ADLs, we used the same questions to assure comparability. Similarly, we were careful to include explicit definitions and descriptors. In various stages of development the instrument, "Patient Assessment Instrument for Medicare (PAIM)," was reviewed by over 20 clinicians and researchers on the project staff or elsewhere involved in long-term care. A copy of the PAIM is contained in Appendix A.

A second type of data -- discharge information or discharge impediments -- were collected on a separate form which was completed upon the patient's discharge or on the 75th day after data collection began in each facility, whichever came first. For most patients therefore, we had information on their discharge. The data collected included:

Discharge date or date of assessment
Discharge destination (if discharged)
Current payment source (if not discharged)
Major impediments to discharge (if not discharged).

The data were merged by patient so that for each assessment these items could be tested as clustering variables. A copy of the "Exit Form" is attached as well in Appendix B.

Resource measurement. Resource measurements considered three major categories: nursing staff time, auxiliary (therapist and physician) time, and other costs (e.g., laboratory procedures, medications, etc.)

Nursing staff time represents the bulk of cost in nursing homes, across all patients and therefore represented the majority of the data collection effort. This staff time measurement (STM) was based on self-reporting by facility staff. All staff--

registered nurses (RNs), licensed practical nurses (LPNs), aides and orderlies (A/Os), nursing assistants, nurse therapists, and ward clerks -- assigned to the study nursing units were asked to record separately their time spent for individual patients and on various unit activities.

All time spent in direct patient care, either hands-on or for the patient (e.g., discussing the patient in a staff conference or with a physician on the telephone, or with the patient's family) was associated with that patient. All time that could appropriately attributed to individual patients was so designated. Time spent on unit activities, including staff meetings, team conferences, inservice training, 24 hours report, paperwork, ward maintenance, supplies, etc., were collected in six categories:

Meetings and Discussions
Documentation and Auditing (Writing Notes and Reports for aides/orderlies)
Ward Maintenance, Supplies and Other Routine Ward Activities
Administration (for RNs and LPNs)
Off Unit
Meals and Breaks

These times were later allocated to individual patients. As staff recorded <u>all</u> time spent on the unit, we could institute procedures designed to assured that the total time recorded matched well with total time available. This resolved a problem we earlier identified as one of the major difficulties with self-reporting data collection.

As part of this data collection, we identified patients whose care times would be unrepresentative because they had a private duty nurse or aide (48), were cared for on a shift with student nurses (38), were on leave of absence (1), or for whom the STM was judged inaccurate by the case mix nurse in consultation with the facility (122). In total, 209 assessments were eliminated for these reasons. As well, the methodology was not appropriately followed in a few facilities; about five "waves" were also eliminated from the data, resulting in an additional loss of only about 150 observations.

Each wave, the STM was performed on the day and evening shifts. An analysis of the RUG-II data demonstrated that night time resource use was both low (it represented only 21% of the total cost of caring for a patient) and highly correlated with day and evening use (Pearson Correlations of .88); thus little information would have been gained by a 24-hour data collection effort.

A second major category of resource use was the time spent by therapists, social workers, physicians, transportation aides, etc. These times were collected via a log which was attached to patients charts for seven day period in each wave. Although time data for a large number of types of staff were included, only those for a few were significant, and our later analysis included

costs only for occupational, physical, and speech therapists, and social workers.

The final resource measure we considered was that of ancillary services, including blood administration, pharmacy, radiology, laboratory tests, and medical, surgical, and central supplies. We requested from each facility the Medicare bill which included the day on which the STM was performed, and their cost to charge ratios. For many facilities, these bills covered an entire month or nursing home stay. These data were provided by most facilities, but preliminary analysis showed significant discrepancies and very low costs. On the basis of these analyses and clinical judgement, it seemed reasonable not to include ancillary cost data in our analyses; there is good reason to believe that, where significant, these costs are highly correlated with the other staff costs we collected. As a single example, pharmacy costs, often the largest of these costs, can be expected to be highly correlated with nursing time, which includes that for administering medications.

Cost data. The final type of data necessary was the cost of the several types of resources used in the care of patients. The business offices of participating facilities provided the total costs, the number of days paid, and the number of days worked for each type of staff. From these we constructed an hourly wage for hours worked. In addition, we obtained from the appropriate departments of each nursing home the percentage of time "auxiliary" staff (therapists, social workers,etc.) spent on direct care activities. These percentages allowed us to impute the appropriate amount of indirect time to be allocated to each patient who received direct care from auxiliary staff.

III.B Analysis

The data collection phase provided us with an accurate database of patient observations consisting of patient characteristics and the resources utilized to care for these patients. We describe here the major steps followed in deriving a classification system for Medicare.

III.B.1 Clustering: Conceptual Overview

The major portion of the analysis was the derivation of a patient classification system using a clustering approach denoted Automatic Interactions Detection (AID).(Morgan and Sonquist, 1963) This statistical methodology was used to form both the original RUG and the RUG-II system, and earlier, to derive the Diagnosis Related Groups (DRGs).(Fetter et al. 1981) First, a dependent variable is chosen, for example the cost of caring for a patient for a single day, as well as a set of patient characteristics that are potentially useful in explaining differences between patients in this cost. In clustering, the full set of patients is recursively partitioned into subgroups by a set of splits, with each split based on the values of a particular independent variable and

chosen so that the predictive error of the dependent variable is minimized. Alternately stated, a split is chosen on statistical grounds if the resulting groups are relatively more homogeneous in the dependent variable. A measure of the power of making one or more splits is "reduction in variance," the percentage of the total variability (between patients in the dependent variable) that is explained with these splits; the remaining variability is that which remains within the relatively more homogeneous groups.

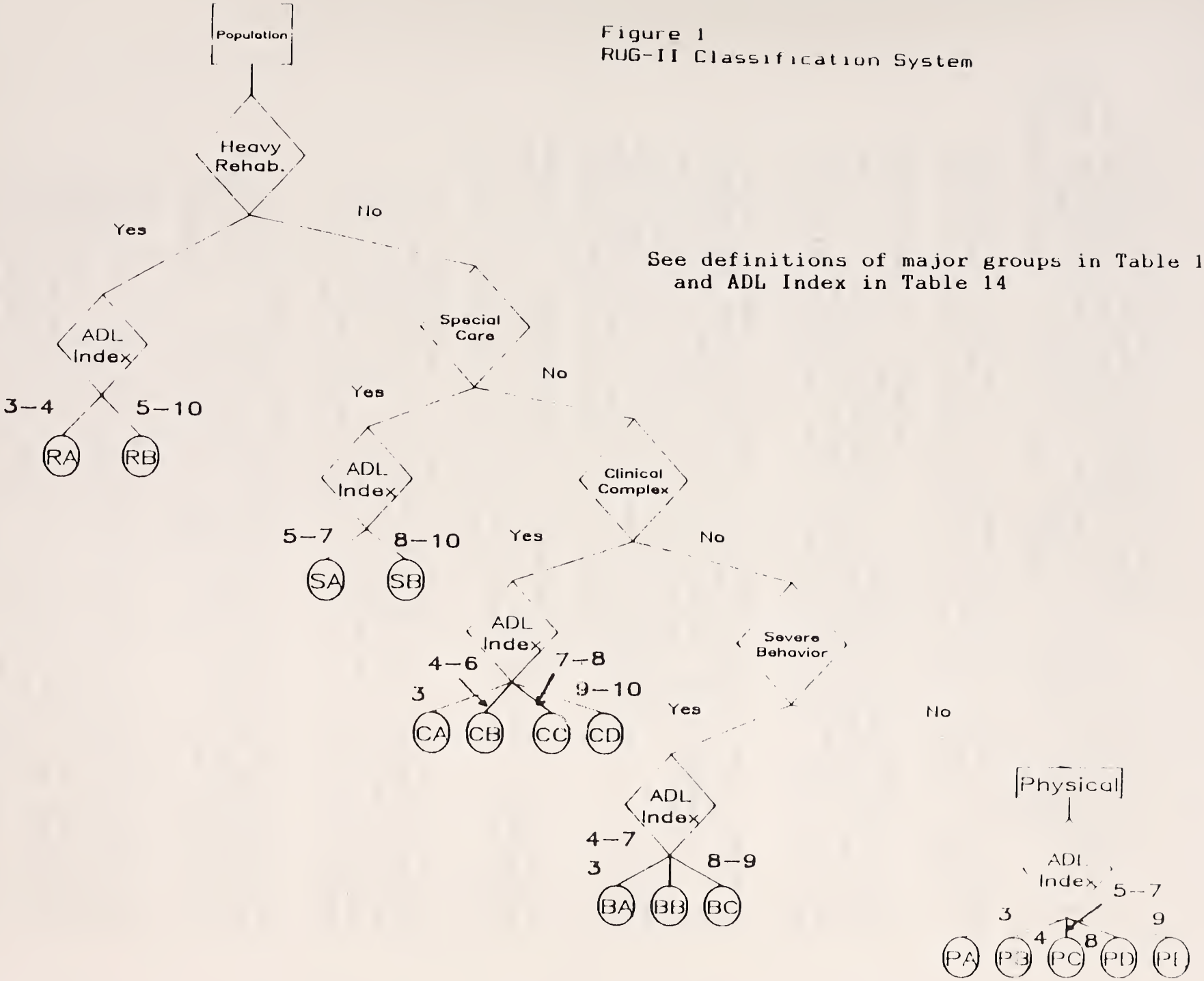
It is important to understand that grouping systems employ only a limited number of characteristics to classify patients. While clinical description of a patient would require a fuller appraisal, with the correlations inherent between characteristics, the presence of a single attribute of a patient is an indicator of a spectrum of others. For example, in our RUG-II classification system for Medicaid nursing home patients, if patients are independent in the three ADLs, they are unlikely to be other than independent in the remaining ADLs such as bathing, mobility, or personal hygiene, to be mentally confused, and so forth. Thus a parsimonious set of descriptors is sufficient to understand the resource use of a nursing home resident.

The particular implementation of AID used in this project was AUTOGRP, an interactive statistical clustering and data manipulation package.(Mills et al., 1976) AUTOGRP permits the user to interactively create variables and new groups, and to project the best possible split of a group based on a given variable, and to evaluate the statistical properties of any set of splits.

Once the best possible system of splits is identified, the population is uniquely partitioned into several patient groups, with each patient a member of one and only one group. For example, the final RUG-II classification system is displayed in Figure 1, along with criteria for forming each of the 16 groups, represented by the small circles. Our analysis of the New York State data found that at 53%, this system had the best variance reduction of all systems constructed.

Although AUTOGRP was the major statistical method used in deriving groups, a variety of other methods were also employed. For example, outliers were evaluated to look for patterns indicative of variables that might be incorporated into group definitions, multiple regression and ANOVA analyses assisted in evaluating patterns of care over time (see Section IV.E). In addition to variance reduction as a statistical measure of the appropriateness of derived systems, we evaluated as well the final groups for homogeneity (as measured by the coefficient of variation) and for sensitivity to outliers.

Figure 1
RUG-II Classification System



See definitions of major groups in Table 13 and ADL Index in Table 14

III.B.2 Criteria for Forming Groups

Statistical variance reduction is not the only criterion used in the definition of groups. We maintain that clinical and policy issues have an equally important role. In the development of the RUG-II study we proposed a variety of criteria which we have adopted as well in this project. These criteria include:

- **clinically rational** - a classification system that follows providers' frameworks of the types of patients seen will have increased acceptability and be more broadly useful.

- **statistically rational** - a quantitative measure of the ability of a classification system to predict the cost of care is the Reduction in Variance discussed earlier. Equally important is that groups be relatively homogeneous in their resource use; although related, these two are distinct criteria.

- **limited number of groups** - a system with a large number of fragmented groups will have less utility, as it will be difficult to apply in reimbursement or management. In total there are 467 DRGs for acute care, but many of these are defined on distinct surgical procedures. We expected that fewer than 25 groups would be appropriate in long-term care populations, and found that the RUG-II system was most appropriately designed with 16 groups.

- **choice of classification characteristics** - patient characteristics that are clinically and statistically appropriate may not be usable for a reimbursement system. One should choose characteristics that are:

  - not subjective. Objective criteria need to be set so that assessors can validly and reliably indicate patient characteristics. In some reimbursement system (such as that in New York) where facilities do their own assessments, these criteria must be sufficiently well defined to support external audit.

  - not affected by facility policy. Patient characteristics which are directly associated with facility policies are avoided. For example, in some nursing homes bathing must be supervised, independent of the functional capability of the individual.

  - hard to game. Where feasible, characteristics that are relatively harder for facilities to manipulate should be chosen. Some treatments, for example, are easily performed and would marginally even help a patient, yet their inclusion in a system would move the patient's classification to a higher resource group.
  - not related to treatments or services. Where possible, it is better to use the <u>need</u> for services rather than an indication of their <u>provision</u>. As we discuss later,

however, for the Medicare population there are some complex tradeoffs to ruling out such characteristics.

- link to quality of care. Where possible, we include variables that can serve the additional role of measuring or indicating quality of care. Such inclusion permits data collected for reimbursement purposes to be utilized as well for quality assurance, thereby reducing paperwork as well as strategically placing data collectors so that they will neither over- nor under-report case mix data.

- insensitive to small changes. A system that is relatively stable and does not recognize small changes in patients' condition will reduce the incentives for it to be gamed. As discussed earlier, this is one of the advantages of a group-based classification system.

- stable over time. If patients do not move rapidly between patient groups, then a payment system can be designed based on few or even a single assessment. We considered the movement between groups for patients for whom we had more than one assessment (see Section IV.F).

- provide positive incentives. Again where possible, characteristics should provide incentives to the nursing home industry to delivery quality care, for example recognizing that the regular toileting of an incontinent patient requires significant staff time which should be reimbursed.

The initial analysis sought a classification system meeting the criteria enumerated above, with good prediction of per-diem cost. We discuss later, in Section IV.G, the methodology we pursued to consider an case-based system.

III.B.3 Construction of Dependent Variables

Clustering requires the use of a single dependent variable; in our application, one representing the relative cost of the resources used in caring for a patient over a single day. From the data collection we had measures of nursing staff time by type of staff (RN, LPN, Aide/Orderly) and by shift, and the time staff spent on unit activities not directly involved in patient care; as well as measures of the time spent by other staff (therapists, social workers, physicians, etc.) over a seven day period. (As discussed earlier, a third measure of resource use, the ancillary costs of laboratory procedures, medications, etc., were not used in the analysis.) Also available were the computed hourly costs of each type of staff and for non-nursing staff an estimate of the percentage of time spent in other than direct patient care. Not every facility provided cost data, and there were some serious inconsistencies in these data; as a result, in several cases

medians across states or several states were used rather than facility-specific values.

Using these elements, two measures of resource consumption were computed -- one for nursing time (RN, LPN, and A/O), the other for therapists and other staff. These two measures can be combined into a single relative cost variable, but, as will be discussed later, it was technically superior to analyze them separately as well as combined. The steps followed were:

For nursing cost:

a. The total patient-centered times for each patient, for each staff type, were computed by adding the times on the day and evening shift.

b. Indirect (unit) nursing staff time for each staff type (RN, LPN, A/O) were categorized into two categories. The first, including the times for documentation and charting, were allocated to all patients on these units proportional to the time staff spent on their care; the second category, including all other unit times, were allocated equally to all patients on the unit. This resulted in a total time (direct and indirect) for each patient, for each type of nursing staff.

c. The relative costs of each of the types of nursing staff were derived in two steps. First, for each facility, the cost per hour for each type of staff was computed by taking the total spent on these salaries divided by the hours actually worked. Again for each facility, these three numbers were divided by their average to obtain a relative cost for RNs, LPNs, and Aides/Orderlies.

d. The relative total cost for nursing care for each patient in the sample is computed by weighting the total nursing time for each type of staff by its relative cost.

The procedure for developing a dependent variable for "auxiliary" staff (PT, OT, Speech Therapy, and Social Work) is similar, with only a difference in the first two steps:

a. The minutes per day of direct patient care for each of the auxiliary staff were standardized to minutes per day.

b. The median value (over all facilities) of the percentage of direct time (the percent of all time spent on direct patient care for that type of staff in the particular facility) was then used as a divisor to inflate direct time to a total (direct and indirect) time. These multipliers were determined by taking the medians of values provided by facilities for each category of staff. Multiplier values are given in Table 2.

Steps (c) and (d) for auxiliary staff were the same, and resulted in a relative total costs for auxiliary staff care for each patient in the sample.

Table 2

Constants used in computing dependent variables

Percent Direct Times

Staff Type	Percent Direct
Physical Therapist	72.00
Physical Therapist Assistant	77.50
Physical Therapist Aide	80.00
Occupational Therapist	67.50
Occupational Therapy Assistant	80.00
Occupational Therapy Aide	80.00
Speech Therapist	80.00
Social Work - Masters	44.13
Social Work - Certified	76.76

Cost Weights

Staff Type	Cost Weight
Registered Nurse	1.34
Licensed Practical Nurse	1.02
Aide/Orderly	.67
Physical Therapist	1.67
Occupational Therapist	2.57
Speech Therapist	2.41
Social Worker	1.83

The procedure used in Step (c) assures that the input price differences, i.e., differences in wages paid, do not cause specific facilities or regions to have an inappropriately strong effect on the results. Later testing showed that the results reported are not affected, however, by this adjustment: essentially the same results would be obtained if wages constant over the facilities (e.g., wages for RNs, LPNs, and Aides/Orderlies in New York State) were used to weight the times in this study. The computed weights for each type of staff are given as well in Table 2.

III.B.4 Constructed Independent Variables

In addition to the individual items available from the patient assessment form (PAIM) and the exit/discharge form, a variety of other variables were constructed and tested for their ability to predict resource use, including:

- Age groups: less than 65, 65-74, 75-84, 85 and over
- Counts of treatments: general treatments, special treatments, all treatments
- Counts of medical problems
- Counts of medications, by type of medication and for all medications
- Time since admission to SNF
- Length of Medicare-covered stay (until end of Medicare coverage, discharge, transfer, or death)
- State, geographic region of state
- Total rehabilitation time (including physical, occupational, and speech therapy, and social work)

Others of particular relevance to this study include:

Diagnosis Groups: With the assistance of several clinicians, the diagnoses indicated as those most important in determining care needs were amalgamated into logical groups, based on clinical relevance, functional similarity and frequency of occurrence in this population. These diagnosis groups are displayed in Table 3.

RUG-II Group: All variables necessary to categorize patients into the RUG-II groups purposefully were collected in this study. A major focus of the analysis was to test the relevance of this system for the Medicare SNF population.

The RUG-II system (Figure 1) is a combination of two major constructed variables. The first is a typography of patients, a hierarchy ranked from high to low resource use, that classifies patients into five groups: (1) heavy rehabilitation, (2) special care (with serious medical problems, e.g., comatose, stage 4 decubiti, quadriplegia), (3) clinically complex (requiring significant medical treatment, e.g., chemotherapy, transfusions, treatment for dehydration, or requiring a physicians visit at least once a week), (4) severe behavioral (manifesting severe

Table 3
Diagnosis groups

Group Name	ICD-9-CM Codes
Amputation	89x..905.9x,996.6x.997.6x,736.89
Arthritis	71x.,72x.,730.xx,735.xx,V436., V430.6
Bone Disorders	26x.,275.4x,733.00
Cardiac Diseases	41x.,42x.,90x.,518.4,394.90,785.04, V458
Other Cerebro-neurological Disord.	348.,780.,85x.,80.11,310.2x,435.9x, 768.6x,V452.
Cerebro-vascular Accident	342.,430.,432.,434.,436.,772.2x, 324.0x
Degradation of Neurologic Function	332.,333.,340.,276.
Dementia	290.,294.,331.0x
Endocrine Disorders	24x.,25x.
Gastric Disorders	53x.,55x.,56x.,57x.,787.4x,789.0x, 936.,997.4x,V441.,V553
Hemolytic Disorders	28x.
Hemorrhage	459,578.9x
Hip Fracture	820.,821.
Late Effects of CVA	437.,438.
Lower Extremity Fractures	821.2x,822.,823 ,824.,828.
Other Fractures	733.81,805.,807.,808.,81x,,829.
Peripheral Vascular Disord.	44x.,451.,453.,454.,707.1x,707.9x, 785.4x
Post-operative care	906.,998.,V508.,V584.,V660.0x
Renal Disorders	403.9x,58x.,593.
Respiratory Disorders	46x.,48x.,49x.,50x.,510.,511.,519., 786.09,799.1x,V440.
Skin Disorders	681.,682.,684.,70x.
Soft Tissue Disorders	83x.,84x.,959.,924.01
Spine Disorders	806.,767.4x
Tumors	1xx.,20x.,23x.,V100.5x,V103.

Notes: ICD-9-CM numbers given with "x" indicate that any digit can replace the indicated value(s)
ICD-9-CM numbers given with only the first three digits (e.g., 431.) indicate any codes with these first three digits.

physical aggression, regression, verbal abuse, or hallucinations),and (5) reduced physical functioning (all patients who do not fall into any of the first four groups). Patients are classified into the first hierarchical group for which they qualify, as this classifies them by their most serious and resource-intense problem.

The second component of the RUG-II system is an "ADL Index" which combines the scores for three individual ADL variables: toileting, eating, and transfer. Each of the three ADLs are scaled from one to three (a level four exists for eating, for patients who are fed parenterally or by tube), then summed to an index from three to 10. Table 14 describes in greater detail the construction of this index. This index compactly and efficiently summarizes the information contained in all of the eight ADL variables.

The RUG-II classification is formed by first locating patients within the clinical hierarchy, then placing them in individual RUGs within that category using ranges of the ADL Index. In total, the system consists of 16 mutually exclusive groups shown in Figure 1. The first RUG-II group, denoted "RA" in the exhibit, contains all patients who have heavy rehabilitation services (with a restorative goal) and who have an ADL Index value either three or four. A second group, "RB," consists of the remainder of the Heavy Rehabilitation patients (with ADL Index scores from five to nine. The other groups are similarly specified.

It is important to understand that the RUG systems employ only a limited number of characteristics to classify patients. While clinical description of a patient would require a fuller appraisal, with the correlations inherent between characteristics, the presence of a single attribute of a patient is an indicator of a spectrum of others. For example, if patients are independent in the three ADLs involved in the Index, they are unlikely to be other than independent in the remaining ADLs such as bathing, mobility, or personal hygiene, to be mentally confused, and so forth. Thus this type of system provides a parsimonious approach to patient classification.

The RUG-II system displayed in Figure 1 is slightly different in form than the original RUG-II system, but the difference is not of practical significance. In our original RUG-II model, the hierarchy began by splitting out the "Special" patients before the "Heavy Rehabilitation." Based on our analysis of the costs of rehabilitation in New York State, this group is in fact the most costly to care for and was elevated to the top of the hierarchy; this change also fits well into the analyses in the current study. As these groups are almost always mutually exclusive, this change has minimal impact.

The development of a per-diem classification system proceeded in a pair of parallel but related thrusts. First, we carefully

considered the appropriateness of the RUG-II system for classifying Medicare patients. If appropriate, either intact or modified, having a common system for all patients in nursing homes -- Medicare and others -- would assist in reimbursement, regulation, and facility management. In considering revisions, it was expected that the classifications involved with rehabilitation patients would be those most likely to be affected. The results of applying the RUG-II system to Medicare patients could also be contrasted to the results on all patients in the New York State (RUG-II) study as well as to Medicare patients in this same study. Second, we began anew to consider the development of a new system, focusing particularly upon the identification of patients with admissions for rehabilitation and medical problems. This has lead us to the Hierarchy of Expected Rehabilitation which we discuss in a later section.

III.B.5 Per-diem vs. per-case classification systems

For the majority of the nursing home population, that funded privately or by Medicaid, length of stay is highly variable. It follows that any reimbursement system would have to recognize such variation explicitly, and thereby could not fully base payment on a case basis. Thus the RUG-II system was derived to explain per-diem nursing home costs. (It should be noted that mixed per-case and per-diem system could be envisioned, and perhaps would have some unique advantages, but none have yet been considered in either the acute care or long-term care sectors.) For Medicare, however, with a limited benefit of 100 days and relatively shorter lengths of stay, a per-case system might be technically feasible. In a second phase of analysis we addressed this issue of feasibility. We first examined the practicality of explaining the Medicare length of stay for those patients discharged, using variables in the data base and the Medicare classification systems we derived in earlier steps. Second, we evaluated the patterns of resource use over the length of stay both for the entire sample as well as for each derived patient classification. Identification of such patterns would enable us to fit a curve of resource use for each patient group and then accumulate these resources to a total case cost. Barring such success, we could evaluate the effect of the day of stay on resource use, to determine if the time since admission was a factor which could be exploited in a per-diem system.

IV. Results

Using the methodologies described earlier, over a three month period in early 1985, we collected a sample of 3306 usable observations. Included were 2561 observations involving 1684 Medicare patients (Table 4). Two thirds of these patients were observed only once, 28% twice, and 7% all three times. The balance of the data set consisted of 745 observations of non-Medicare patients on these same units; almost all (628) of these were observed only once. We discuss the analysis of this latter group of patients in Section IV.H; except for this discussion, we focus in the remainder of this section on the Medicare patients in the sample.

In the process of the data collection, we eliminated several waves of data collection for specific facilities, due to methodological failures in their data collection. This resulted in the loss of 379 observations, most from dropping a single facility with staffing problems. As well, during the case mix nurse audits, a variety of inconsistencies were uncovered that could not be resolved, or special conditions existed in facilities that prevented use of individual data points. This latter included patients off the unit during the staff time measurement, use of a private duty nurse, or student nurses omitted from the data collection. In total, 122 additional observations were lost from analysis, resulting the sample sizes given in the previous paragraph.

To evaluate the effect of individual facilities, we performed basic AUTOGRP analysis eliminating facilities that potentially could have caused spurious results. In each of three experiments -- dropping the five facilities with the highest mean total cost and the ten with the lowest; dropping the five with the highest and the five with the lowest total auxiliary (rehabilitation) times; and dropping the ten facilities which our audits indicated were those most likely to have had data collection problems -- we found little to no difference in our results. For much of the reported results, we utilized 2272 out of the 2564 observations collected, eliminating an additional 289 observations collected in particular facilities or waves of data collection which on analysis indicated potential data collection concerns. Nevertheless, analyses were performed both with and without these observations and with no significant difference in our results. Aside from these, no individual patients were dropped from the data set.

Although strict stratification was not possible, we attempted to distribute the sample across the states, by ownership, and whether hospital based. Table 4 displays several of the characteristics of the sample. Fewer facilities were sampled in New York State as we were unable to locate units that were predominantly Medicare, and the facilities we did sample were all not-for-profit. Although the sample is not balanced over the displayed characteristics, this was not the goal. The sample,

Table 4
Characteristics of sample

Sample Size

Sample	Number of Assessments	Patients
Medicare Patients	2561	1684
Non-medicare Patients	745	628
Total:	3306	2312

Characteristics of Medicare Sample

Distribution Across States

State	Percent of Facilities	Percent of Sample	Percent of Sample Freestanding	Percent of Sample For-Profit
New York	10.5%	11.7%	71.4%	0.0%
Pennsylvania	31.6%	28.8%	26.2%	4.3%
Florida	26.3%	29.3%	25.7%	4.3%
Illinois	13.2%	10.8%	11.6%	30.4%
California	18.4%	19.5%	6.4%	20.2%
Total	100.0% (38)	100.0% (2564)	71.7%	42.1%

Other Characteristics

Mean SNF bed size for sampled facilities:	168.0
Mean Medicare assessments per facility:	67.5

taken together, can be expected to represent the spectrum of patients, including a spectrum of types and sizes of facilities. On the other hand, despite the broad coverage indicated, we did not perform any analysis to compare or contrast facility types as the study was not designed to represent an appropriately stratified or sufficiently large sample of facilities.

IV.A Overview of data

The distributions of selected patient characteristics in the Medicare sample are given in Table 5; full details are included with the sample questionnaire in Appendix A. Over 74% of the Medicare patients were admitted for temporary restorative care, including 24% for hip fractures and 18% for Cerebrovascular Accidents (CVAs), and 8% for temporary care involving skilled nursing services not feasible in the home of the patient. It is interesting to note that despite the fact that Medicare does not explicitly cover this benefit, over 9% of the patient were admitted with the expectation of placement of more than six months. There are fairly high incidences of medical problems, including over 9% of the patients considered as terminally ill, 62% with gait disorders, 6% with upper body contractures and the same percentage with lower body contractures, 22% with hemi- or paraplegia, 7% with elevated blood sugar, and 10% with dyspnea. Of these patients, 32% had some type of decubiti, although in only in only 5% of the patients were they of Grade 4.

Information collected at the time of discharge (or at the end of the study period) indicated that 50% of the patients were or expected to be discharged home (Table 6). With Medicare funding only short-term rehabilitation or skilled nursing care, 31% of the patients remained in the same facility or were transferred to other long-term care facilities. Of the 4.6% transferred to another SNF, some may have had Medicare coverage there.

The data strongly support the hypothesis that the Medicare population is significantly different than the balance of patients who dominate the nursing home population. In Table 7 we contrast for a selected set of characteristics the Medicare sample with our earlier sample of all (and thereby mainly Medicaid-funded) residents in New York State nursing homes, both SNFs and Intermediate Care Facilities (ICFs). (The last column contrasts these groups with the non-Medicare patients in our sample, and is discussed later in Section IV.H.) It follows from the wide difference in admissions reason -- restoration for most Medicare patients and few others -- that the Medicare population generally had more serious medical problems. Also, with shorter stays in nursing homes, the lower frequencies of mental problems related to long-term care (e.g., regression, hallucination, wandering) was expected.

The contrast in levels of function, as measured by the Activities of Daily Living (ADLs), were less well defined. For eating, the ability of patients to feed themselves, the Medicare

Table 5
Selected characteristics of Medicare SNF patients*

Reason for Placement:		
Temporary Restorative		74%
Hip fracture	24%	
Cerebrovascular Accident	18%	
Temporary care		8%
Long-term placement		9%
Medical Problems:		
Terminally ill		9%
Gait disorder		62%
Upper body contractures		6%
Lower body contractures		6%
Hemi- or paraplegia		22%
Quadriplegia		1%
Dyspnea		10%
Stasis Ulcer		9%
Decubitus - stage 4		5%
Severe pain		9%
Mental Problems:		
Wanders		3%
Verbally abusive		7%
Physically aggressive		4%
Regressive		6%
Hallucinates		2%
Socially withdrawn		18%
Disoriented		29%
Functional (ADL) Independence (including minimal supervision):		
Mobility		15%
Transfer		24%
Eating		72%
Dressing		21%
Bathing		34%
Toileting		31%
Continence:		
Bowel continent		61%
Bladder continent		51%
Indwelling Catheter		29%

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* See Appendix A for individual questions and distributions of responses.

Table 6

Distributions of Responses on Exit Form

	Percent of Assessments**	Percent of Patients**
Reason to Complete form*		
Discharged or discharged from Medicare Part A Coverage	85.2%	85.5%
Designated conclusion of study	14.7%	14.4%
Major Impediments to Discharge Home* (74% not responding, most as instructed)		
Severe or Unstable medical condition	28.2%	27.9%
Inadequate functional level	46.1%	45.7%
Severe mental or behavioral problem	4.7%	5.3%
Poor motivational level or refusal to leave facility	3.5%	3.6%
Inadequate informal emotional support	2.6%	2.3%
Inadequate informal functional support	6.2%	6.3%
Inadequate formal community support	2.3%	2.0%
Inadequate financial support or inadequate housing	0.6%	1.0%
Cannot determine	5.6%	5.8%
Discharge destination of patient*		
Home	49.1%	50.2%
Different level of care	14.0%	13.7%
Remain at SNF level in facility	15.0%	12.7%
Remain at SNF level in another facility	4.4%	4.6%
Hospital	9.6%	10.2%
Died	8.8%	8.1%
Payment source after Medicare if remaining in SNF* (78% not responding, most as instructed)		
Medicaid	26.0%	25.4%
Veterans Administration	0.4%	0.3%
Private Pay	59.1%	58.5%
Blue Cross	7.0%	7.5%
Other private insurance	6.3%	6.6%
Other	1.3%	1.8%
Reason Medicare was terminated* (69% not responding)		
Denial by fiscal intermediary	74.5%	77.4%
Depleted 100 allowable days	22.7%	19.4%
Depleted lifetime reserve days	0.3%	0.2%
Patient choice	2.5%	3.0%

*See form for more complete questions

**Percent indicating listed responses, of those indicating any response

Table 7
Comparison of Medicare with New York State Medicaid patients

Patient Characteristic		Medicare*	NYS**	Non-Medicare+
Admission reason:	restorative	74%	5%	69%
Medical problems:	edema (all)	24%	15%	16%
	contractures	9%	23%	21%
	stasis ulcers	9%	1%	4%
	decubiti (all)	32%	11%	33%
	nasogastric feed	8%	2%	5%
	parenteral feed	2%	1%	1%
Restraints:	vest	19%	17%	30%
	belt	11%	32%	12%
	pharmaceutical	3%	8%	13%
Mental/behavioral:	does not understand well	49%	69%	39%
	wanders	3%	10%	7%
	verbally abusive	4%	25%	17%
	physically aggress	4%	24%	9%
	regressive	6%	35%	13%
	hallucinates	2%	6%	3%

---

* All Medicare observations, n=2564.
** Mainly Medicaid and private pay patients, n=3427.
\+ Non-medicare patients on units in study, n=705.

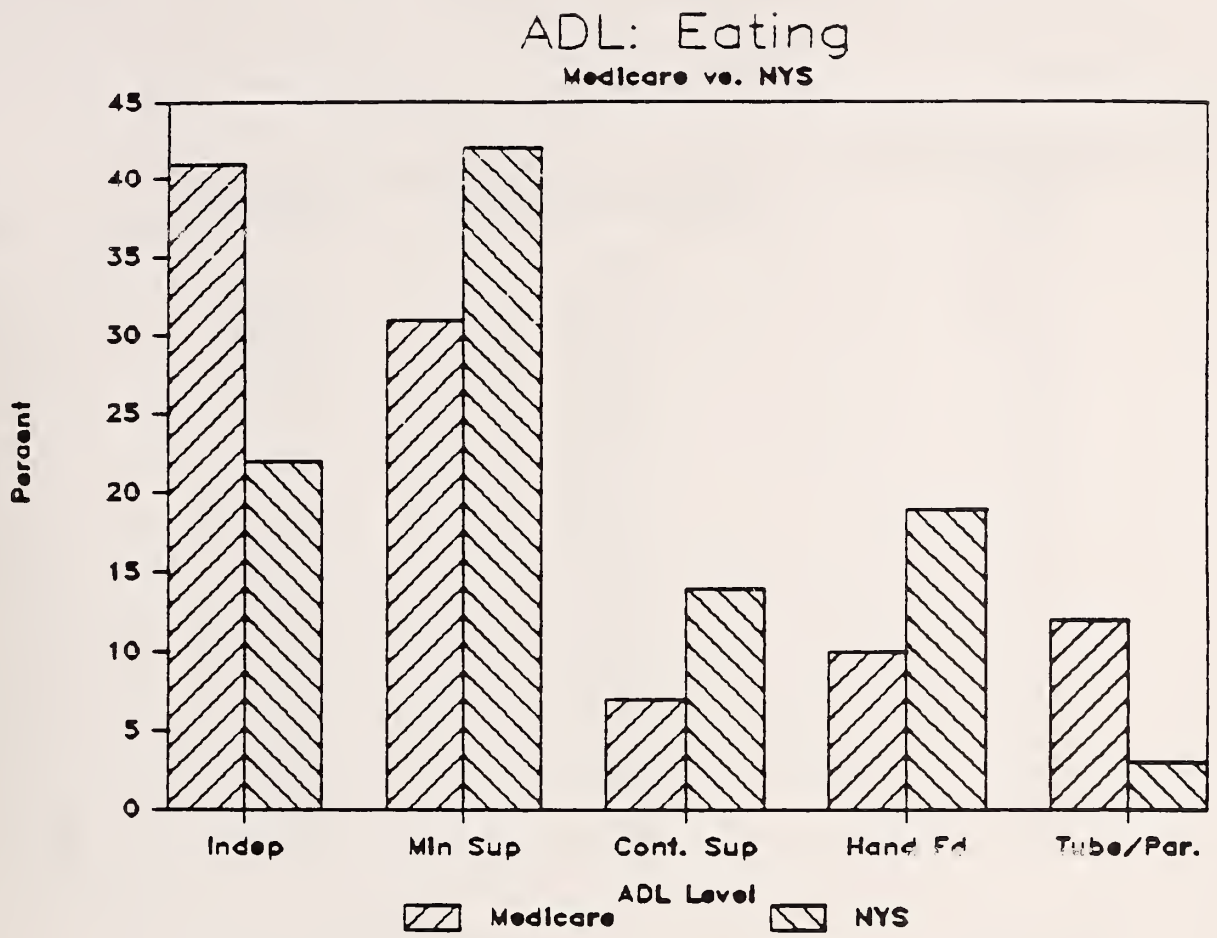
patients were more likely to be either totally independent or on tube or parenteral feeding; less likely in the partially dependent ranges usually seen in long-stay patients (Figure 2). However, for toileting (see Figure 2, bottom), Medicare patients were more likely to be partially dependent, requiring minimal or continuous supervision, or continuous assistance. As well, if they are incontinent, they are almost always toileted, since they can be expected to be rehabilitated and discharged.

The tools we derive in this project allow us to produce more unified comparisons of patient characteristics by identifying those that are important in differentiating patients and populations. These results are discussed later in Section IV.D.

The distribution of length of covered stays of Medicare patients in the sample is given in Table 8. Shown only are those lengths of stay representing the full time from initial admission until death, discharge, transfer, or termination of Medicare coverage. Fifty two percent of the patients had lengths of stay under 30 days and 90% under 80 days. (The 2.2% of patients with lengths of stay in excess of 100 days appear to be reports of entire stays rather than only the Medicare portions.) The lengths of stays of patients who did not die are only slightly shorter than those discharged or transferred. Patients who are discharged home (with mean length of stay of 32.3 days) and those moving to hospitals (30.8 days), however, have significantly shorter stays than those who remain in long-term care facilities, either the same SNF (58.5 days) or another SNF (38.0 days), or another level of care (45.5 days), as shown in Table 8.

The second corpus of data collected, that describing the staffing resources and costs involved in the care of the Medicare patients in the sample, is summarized in Table 9. Costs of providing care are obtained by weighting the actual times spent by staff members, using facility-specific constants representing the relative wage of that type of professional (see Section III.B.3). The weights displayed are relative to the average salary of nursing staff, approximately $7.13. Thus each of the dependent variables can be scaled to actual cost by multiplying by $7.13. For example, the total cost per day (2 nursing shifts and auxiliary costs, both direct and indirect times) is 4.74*$7.13 = $33.79, of which 60% represents the nursing component. As expected, there is high variability across individual patients in the utilization of resources. These dispersions, as measured by coefficients of variation, are commensurate with those seen in the nursing home population in New York State.

We found that the analyses of which characteristics explained resource use came to virtually the same results if we employed total times and or costs, or logarithms of these times or costs; we report here on results for daily costs. It was found to be important, however, not to restrict our analysis to total (nursing plus auxiliary) cost, but rather to consider each component separately. Auxiliary costs accounted for 39% of the total costs


ADL: Eating
Medicare vs. NYS
Percent
45
40
35
30
25
20
15
10
5
0
Indep
Min Sup
Cont. Sup
Hand Fd
Tube/Par.
ADL Level
Medicare
NYS

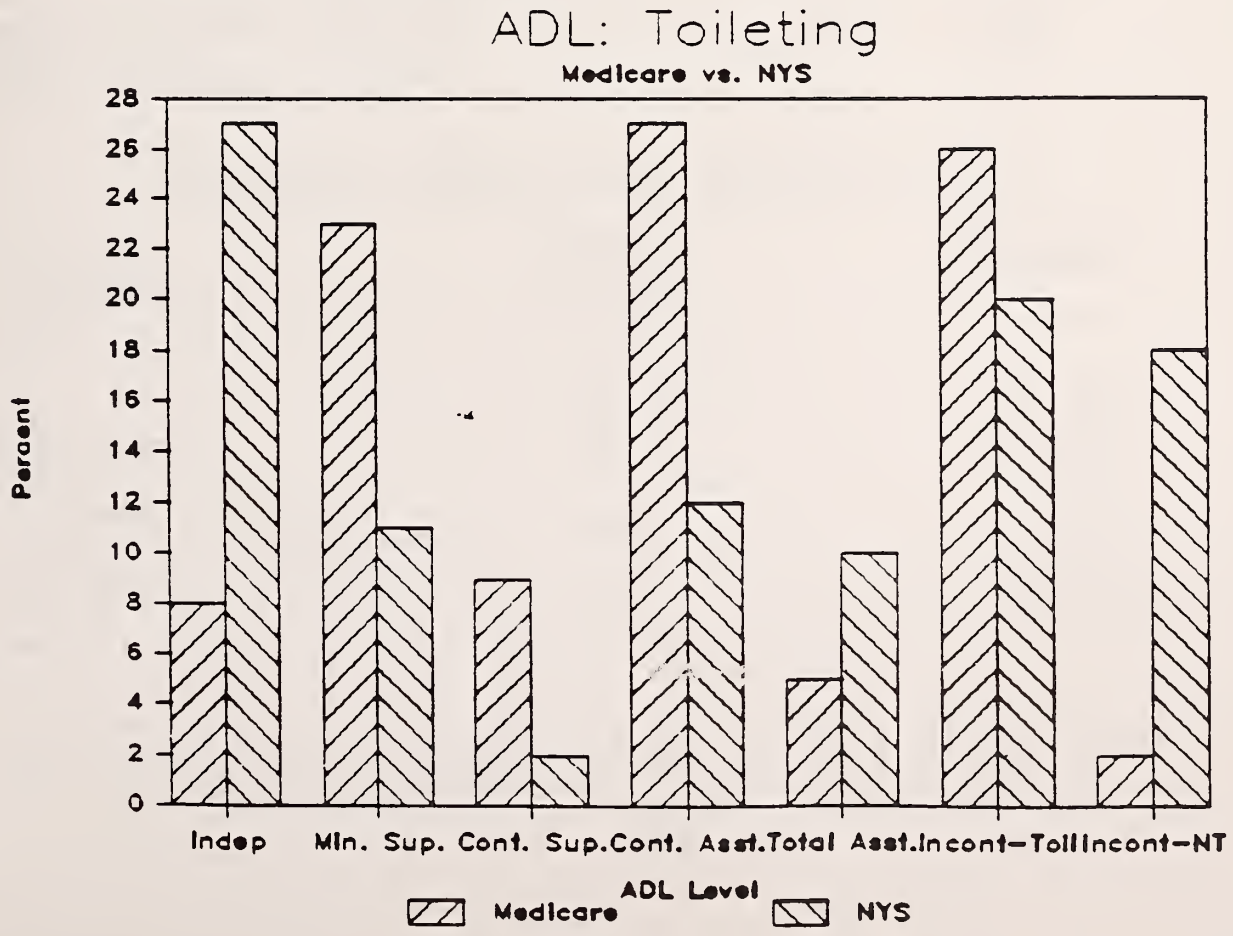

ADL: Toileting
Medicare vs. NYS
Percent
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Indep
Min. Sup.
Cont. Sup.
Cont. Asst.
Total Asst.
Incont-Toil
Incont-NT
ADL Level
Medicare
NYS

Table 8
Length of covered stay

Distribution

Days	All Patients Percent	All Patients Cumulative Percent	Patients not Deceased Percent
1-10	9.3%	9.3%	8.9%
11-20	20.5%	29.8%	20.7%
21-30	22.7%	52.5%	22.9%
31-40	14.3%	66.8%	14.8%
41-50	9.8%	76.6%	10.2%
51-60	6.4%	83.0%	5.7%
61-70	4.1%	87.1%	4.3%
71-80	3.1%	90.2%	2.8%
81-90	2.1%	92.3%	2.0%
91-100	4.4%	96.7%	4.7%
101-110	1.1%	97.8%	1.2%
111-120	0.7%	98.5%	0.6%
121-130	0.6%	99.1%	0.7%
131-140	0.3%	99.4%	0.3%
141-150	0.1%	99.5%	0.1%
151-160	0.2%	99.7%	0.2%
161-170	0.2%	99.9%	0.2%
171-180	0.0%	99.9%	0.0%
181-190	0.1%	100.0%	0.0%
Mean:	37.6 days		37.5 days
Standard Deviation:	27.9 days		27.7 days
Median:	30 days		29 days
Number of Patients:	1316		1191

Mean Length of Covered Stay* by Discharge Destination

Discharge Destination	Number of Patients	Mean Length of Stay*
TOTAL	1310	37.5 days
Home	665	32.3 days
Remain at SNF	155	58.5 days
Other SNF	59	38.0 days
Other level of care (same or different facility)	160	45.4 days
Adult Home	2	47.5 days
Hospital	152	30.3 days
Death	117	38.0 days

*Days from admission to discharge, transfer, Medicare disapproval or death

Table 9

Descriptive statistics on measures of resource use

VARIABLE	Mean	S.D.	Weight
Components			
RN Day	14.89	19.99	
RN Night	8.63	13.46	
LPN Day	9.46	14.15	
LPN Night	9.01	11.43	
A/O Day	41.01	29.16	
A/O Night	29.16	18.80	
Summary Variables			
Total RN time*	23.52	28.09	1.34
Total LPN time*	18.48	19.59	1.02
Total Aide time*	70.17	37.39	.67
PT Time**	35.59	33.07	1.67
OT Time**	14.18	25.69	2.57
ST Time**	3.75	12.34	2.41
SW Time**	4.68	7.58	1.83
Dependent Variables			
Nursing Time*	112.16	50.46	
Nursing Cost+*	2.88	1.32	
Auxiliary Cost+*	1.87	1.99	
Total Cost+*	4.74	2.40	

*Time for two shifts
**Time per day
+Weighted direct and indirect times

(n=2272)

seen and were found to be negatively correlated with nursing cost; patients who are well enough to have heavy rehabilitation get little nursing care, and, in fact, are off the nursing units a significant portion of the day. It follows that combining these two costs leads to a seemingly anomalous result that it costs less to care for a more disabled patient. These "reversals" were not seen when we restricted the analysis only to nursing costs, or only to patients receiving little rehabilitation. These problems had significant implications for the analyses, which had to consider the two components of cost separately as well as combined. We discuss the implications of this "substitution effect" in later sections.

IV.B Univariate variance explanations

When each of the variables describing patients in the database was evaluated as a potential item upon which to form an initial split, identifiers of the facility, region, and state were those most descriptive of resource consumption (Table 10), with total cost variance reductions of 33.7%, 18.9% and 12.4%, respectively. The range of these variations was close to two to one for states and as much as three to one for individual facilities (Table 11). The care given to patients is thus strongly driven by the care patterns of facilities and regions, and state norms or regulations, a result consonant with that of at least one other author for the acute care setting (Chassin et al., 1986). It also supports the view expressed by practitioners that the criteria for certification of SNF patients for Medicare payment is not uniformly applied (e.g., Smits et al., 1982; Foley and Schneider, 1980). Nevertheless, as we will show, although reimbursement, regulation, and normative practice affect use, patient characteristics do explain a great part of the differences seen in resource utilization.

The patient characteristics which individually explain the cost of resources are shown as well in Table 10. A variety of medical and functional characteristics, including the need for special diets (with variance explanation 7.8%), hearing loss (6.2%) and nursing therapies such as suctioning (6.1%) and tracheostomy care (6.2%) predict nursing costs the best. The ADLs also generally work well: eating was the best individual variable at 8.0%, with transfer and toileting (at 6.2% each) close alternatives. However the variance reductions seen for the ADLs were substantially lower than those in the New York State Project for all nursing home patients, where they achieved individually about 30% variance reduction. For the Medicare population, resource consumption -- even only of nurse and aide services -- is relatively less driven by the need for maintenance services. We were able to construct variables that had reasonable explanatory power (approximately 9.6%) by counting the number of types of treatments or medical problems.

A very different set of variables were predictive of auxiliary services. Most of the best ones were predictive of

Table 10

Variance reduction in resource consumption for Medicare patients

Variable	Total Cost VE	Total Cost Groups	Nursing Cost VE	Nursing Cost Groups	Aux. Cost VE	Aux. Cost Groups
Data Variables						
OCCUPAT. THERAPY	39.0	2			51.9	2
SPEECH THERAPY	26.7	2			30.6	2
IADL TRAINING	19.1	3			25.3	3
OCCUPAT. THER. GOAL	18.6	3			27.5	3
PHYSICAL THERAPY	16.9	2			33.6	2
SPEECH THERAPY GOAL	15.5	2			19.1	2
ILLNESS:reason for placement	13.2	3	5.0	3	21.3	3
SKILL TRAINING	13.4	3	4.8	4	22.8	3
CVA	11.2	2			15.9	2
HEMI-PARAPLEGIA	7.6	2			8.8	2
PHYSIC. THERAPY GOAL	5.5	2	5.7*	2	19.8	3
GAIT DISORDER	4.9	2			8.4	2
SKIN CARE	2.2	2	4.7	2		
AGE	2.9	2	2.2	2		
TURNING/POSITIONING	1.6	2	5.9	2		
EATING			8.0	2	7.1*	2
DIET			7.8	2		
EXP. DISCHARGE DEST.			7.6	3	8.1	3
BOWEL CONTROL			6.3	2	3.7*	2
TRANSFER			6.2	2	7.0**	3
TOILETING			6.2	2	6.7**	2
HEARING			6.2	3	2.7*	2
TRACH CARE			6.2	2		
SUCTIONING			6.1	2		
TERMINALLY ILL			5.0	2	3.0*	2
LEARNING ABILITY			5.0	2	9.2	3
VISION			4.5	2	4.1*	2
NASOGASTRIC FEEDING			4.1	2	3.7*	2
TRACH			3.9	2		
NUMBER IV MEDICATIONS			3.3	2		
DECUBITUS CARE			3.2	2	2.6*	2
OXYGEN THERAPY			3.0	2		
DYSPNEA			2.7	2		
DECUBITUS LEVEL			2.7	2	3.9*	2
INHALATION THERAPY			2.7	2		
WOUND CARE			2.6	2		
ADJ. DEATH AND DYING			2.6	2		
DRESSING			2.5	2	9.7**	2
COMATOSE			2.0	2		
Diagnostic Groups						
Diagnosis groups(25)+	9.7	3	3.3	2	15.6	3
DRGs(33)+	10.8	3	7.2	3	15.8	3
DRG Weights+	0.0		0.0		0.0	

Variable	Total Cost VE	Total Cost Groups	Nursing Cost VE	Nursing Cost Groups	Aux. Cost VE	Aux. Cost Groups
Constructed Variables						
RUG-II System	15.7	16	9.4	16	32.2	16
ADL INDEX			8.1	2	7.0	2
COUNT THERAPIES+	53.8	4			75.4	4
COUNT TREATMENTS			9.58	3		
COUNT MED. PROBLEMS	5.91	2	3.80	2		
COUNT SIGNS/SYMPTOMS			2.24	2		
Others						
FACILITY	33.7	5	25.7	4	21.3	5
REGION	18.9	3	14.3	4	9.3	3
STATE	12.4	3	11.6	2	5.0	3

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*lower levels of dependency associated with higher resource use
**middle levels of dependency associated with higher resource use
+see discussion in text

(n=2272)

Table 11
Variation in costs by geographic region and facility

Range of Costs

	Low		High	
Nursing Cost: (mean=2.90)				
Facilities	1.81		5.02	
Regions	2.20	North Florida	4.37	San Francisco
States	2.47	Florida	3.77	Illinois
Auxiliary Cost: (mean=1.82)				
Facilities	.22		4.81	
Regions	.77	Pittsburgh	4.81	San Francisco
States	1.33	Pennsylvania	2.48	California
Total Cost: (mean=4.70)				
Facilities	2.86		9.59	
Regions	3.23	Pittsburgh	9.18	San Francisco
States	3.84	Pennsylvania	6.00	Illinois

Costs by State:

	PA	FL	NY	CA	IL
Nursing Cost	2.51	2.47	3.18	3.46	3.77
Auxiliary Cost	1.33	1.88	1.40	2.48	2.23
Total Cost	3.84	4.35	4.58	5.94	6.00

resource utilization since they themselves described this utilization: whether a patient received more than 30 minutes per day of occupation therapy (OT - at 51.9%), physical therapy (PT - 33.6%), or speech therapy (ST - 30.6%), and skill (22.8%) or instrumental ADLs (IADL - 25.3%) training. The goals of OT, PT, and ST were predictive primarily for their indication that a patient received such therapies. As we discuss later, care must be used in employing such variables in a classification system since they are themselves measures of resource use. However, other variables described conditions leading to the need for these therapies. The primary reason the patient was admitted to the facility (ILLNESS) was highly explanatory, but primarily as it identified patients with Cerebrovascular Accidents (CVA). Splitting on CVA only achieved close to as much variance explanation (16% versus 21%). Many other variables were in inverse relationship to the resource measure, with higher dependencies associated with lower therapy use -- a result that could be predicted from the "substitution effect" of therapy for nursing time, described earlier. These negative associations cause problems when these same variables were used to predict total resource use: a positive correlation with nursing resources and a negative correlation with auxiliary resources at times vitiated any explanation of total resource use. For the most part, variables with high explanation of auxiliary services (and usually having little effect on nursing) were the best in explaining total cost.

These findings had two consequences. First, any classification system would need to separate rehabilitation and non-rehabilitation patients to permit better prediction of total resource cost. Second, the system would need to be evaluated separately on each of the three cost measures -- nursing, auxiliary, and total -- and some splits might improve variance explanation of only one dependent (cost) variable. In addition, the combination of two effects - nursing cost increasing and rehabilitation costs decreasing with increasing medical and functional debility -- made the total cost and the variability that can be explained extremely sensitive to the relative weighting of these two cost components. It follows that there was unlikely to be a single "best" classification system, but rather ones that were better or worse for particular applications. We elaborate on these points later.

The best variable to predict auxiliary cost was a count of the number of therapies -- physical, occupational and speech -- the patient received for more than 30 minutes per day. Many other variables had significant (if low) variance explanation, but in the "wrong direction," i.e., higher auxiliary costs associated with lower dependencies or lack of medical conditions.

IV.B.1 Activities of Daily Living

The mainstays of virtually every nursing home patient classification system are the Activities of Daily Living. Originally derived to predict rehabilitation potential (Katz, 1963), they are

effective as well in predicting staff time and costs, as shown by a variety of authors and by their inclusion as part of the classification systems in all states using case mix reimbursement. For the Medicare patients in our data the individual ADLs are some of the best for predicting nursing times and costs (See Table 10), but the variance reductions are substantially lower than those see in the NYSCMRP data, which produced variance reductions around 30%. This, in itself, is a major finding of this study: resource consumption -- even only nursing -- is less driven by the need for maintenance services. This same result is seen for the variable we constructed in the NYSCMRP study to summarize the ADL information: the ADL Index of the RUG-II system. At 8.13% variance explanation, this Index was one of the better variables in explaining nursing costs and superior to individual ADLs. However, it, as the individual ADLs, was not effective in explaining either auxiliary or total cost due to the "substitution effect" described earlier, where less functionally disabled patients receiving significant rehabilitation services received less nursing services, with a net lower cost. It should be noted that the variance reduction of this variable, as of any other, in the entire population may be different than that in a more homogeneous subgroup.

IV.B.2 Diagnosis and Diagnosis Related Groups

Diagnosis, by itself, was not especially useful in predicting resource use. First, as coded in the ICD-9-CM system, there are too many diagnoses to provide a clinically sensible categorization of patients so the 25 diagnostic categories described in Section III.B.4 were used. The frequency and mean costs for each group are displayed in Table 12. These groups achieved a total of 9% explanation of total cost, 15% for auxiliary cost; in both cases the majority of the explanation was again due to the identification of CVA patients for whom there were extensive OT and PT services provided.

Diagnosis Related Groups (DRGs), the classification system that forms the foundation for Medicare reimbursement of hospital stays (Fetter et al., 1981), had similarly low variance explanations, although again the analyses need to be carefully performed. DRGs were listed for 1767 (69%) of the patient assessments; a total of 154 different DRGs were named. Allowing all DRGs to be considered would thus again lead to spuriously high variance explanation. We therefore took two approaches to evaluating the DRGs. First, we concentrated on the 33 most frequently listed DRGs, those with a frequency of at least 10 in the sample. These 33 DRGs represented 77% of all the assessments with DRGs indicated. However, despite still being numerous, they were relatively ineffective in explaining cost. They achieved only 10.8% variance reduction of total cost and 15.6% of auxiliary costs. For contrast, they indicated the same dichotomy as the variable indicating the presence of cerebrovascular accident

Distribution and Mean Costs for Diagnosis Groups

Diagnostic Group*	No.	%	Mean Values of Cost Total	Nursing	Auxil.
TOTAL	2554	100.0%	4.71	2.90	1.81
Amputation	52	2.0%	5.18	2.95	2.23
Arthritis	111	4.3%	4.41	2.74	1.67
Bone Disorders	6	0.2%	3.97	2.24	1.73
Cardiac Diseases	110	4.3%	4.19	3.12	1.07
Other Cerebro-neurological Dis.	33	1.3%	4.96	3.43	1.52
Cerebro-vascular Accident	402	15.7%	6.26	3.00	3.26
Degradation of Neurologic Funct.	43	1.7%	4.40	3.24	1.16
Dementia	15	0.6%	3.08	2.87	0.21
Endocrine Disorders	31	1.2%	4.68	3.14	1.54
Gastric Disorders	67	2.6%	3.75	2.92	0.83
Hemolytic Disorders	10	0.4%	4.13	2.61	1.52
Hemorrhage	5	0.2%	4.19	3.52	0.67
Hip Fracture	608	23.8%	4.52	2.55	1.96
Late Effects of CVA	146	5.7%	5.44	2.96	2.48
Lower Extremity Fractures	66	2.6%	4.61	2.61	2.00
Other Fractures	118	4.6%	4.09	2.49	1.60
Peripheral Vascular Disorders	59	2.3%	3.93	2.98	0.95
Post-operative care	14	0.5%	3.49	2.73	0.73
Renal Disorders	17	0.7%	3.69	2.63	1.05
Respiratory Disorders	99	3.9%	4.48	3.54	0.93
Skin Disorders	119	4.7%	4.28	3.44	0.84
Soft Tissue Disorders	10	0.4%	3.86	3.04	0.82
Spine Disorders	13	0.5%	4.79	3.03	1.76
Tumors	177	6.9%	3.84	3.21	0.64
All Others	223	8.7%	4.51	2.84	1.67

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* See definitions in Table 3.

(CVA), but had poorer variance reduction, probably as DRGs indicate the hospital rather than nursing home diagnosis.

A second approach to evaluating the DRGs was to array them by their resource use, thereby preventing spurious correlations. We employed the case mix weights derived by Cotterill in his 1986 study of DRGs in nursing homes. Wage-adjusted total charges per day, provided by Cotterill (personal communication, 1987) for the 66 most frequent DRGs, were used to form an index for each assessment. However, this DRG index did not correlate with any of the costs in this study. In particular, DRGs with higher predicted costs were often associated with lower actual costs.

On the strength of these results, we determined that diagnoses or DRGs alone cannot be effective in explaining nursing home resources for Medicare patients. Rather, particular diagnoses need to be identified and combined with other clinical and functional measures, as we saw in the RUG-II development.

IV.B.3 Resource Utilization Groups (RUG-II)

The need for a rehabilitation/non-rehabilitation split as one of the most important patient descriptors and the power of the ADL Index (at least for nursing costs) showed significant commonalities with the RUG-II system. Figures 3 and 4 display the distribution of the Medicare patients and their case mix index across the 16 RUG-II categories. Only first assessments are shown, to facilitate comparison with New York State data. The group names are those given in Figure 1, with the first letter displaying the hierarchy category (S for Special Care, R for Heavy Rehabilitation, C for Clinically Complex, B for Severe Behavior, and P for Reduced Physical Function). The only change made to the RUG-II system was to drop the requirement of a restorative goal for rehabilitation.

A large number of patients are seen in the rehabilitation group groups, with few in the reduced physical functioning groups more traditionally associated with long-stay patients. The latter figure displays the case mix index representing average total costs for each RUG-II group, standardized to 1.0 for the entire sample. The "sawtooth" pattern in again seen of increasing predicted cost with increasing ADL dependencies within each major hierarchy category, as in the original application of the RUG-II system. The only exception is in the Reduced Physical Function (PA, PB, PC, PD) groups, where the sample size was extremely small. The information in these two figures is perhaps best understood in contrast with the results for the Medicaid nursing home population; these results for both numbers of patients and case mix are contrasted in Figures 5 and 6. Many more Medicare patients are seen in the higher cost groups to the left of Figure 5 -- in the special care, heavy rehabilitation, and clinically complex hierarchy categories; for the Medicaid population the majority of residents are in the reduced physical functioning group. In fact, three groups are not even seen in the Medicare

Figure 3

Distribution of RUG–II

for Medicare Patients

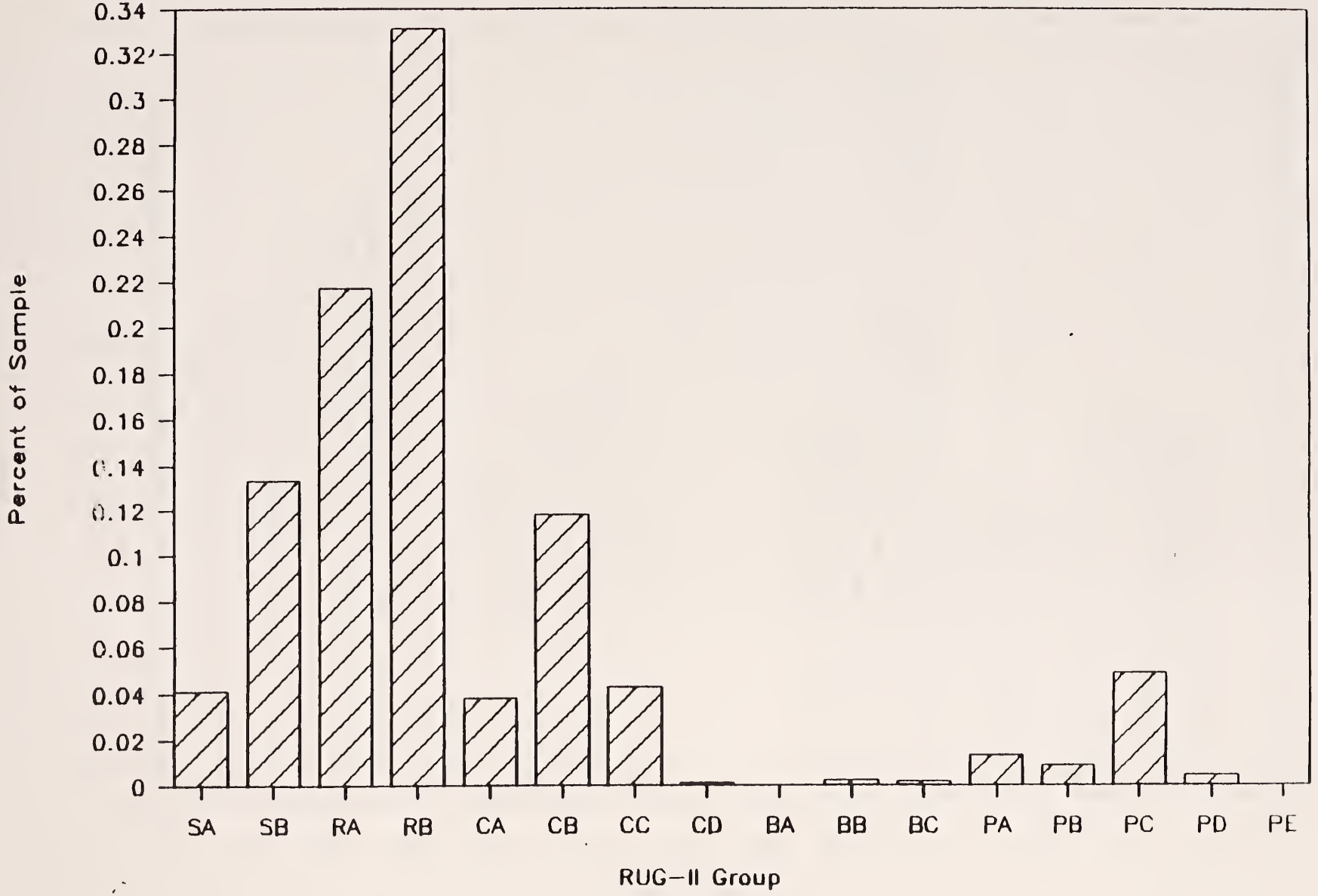


Figure 4

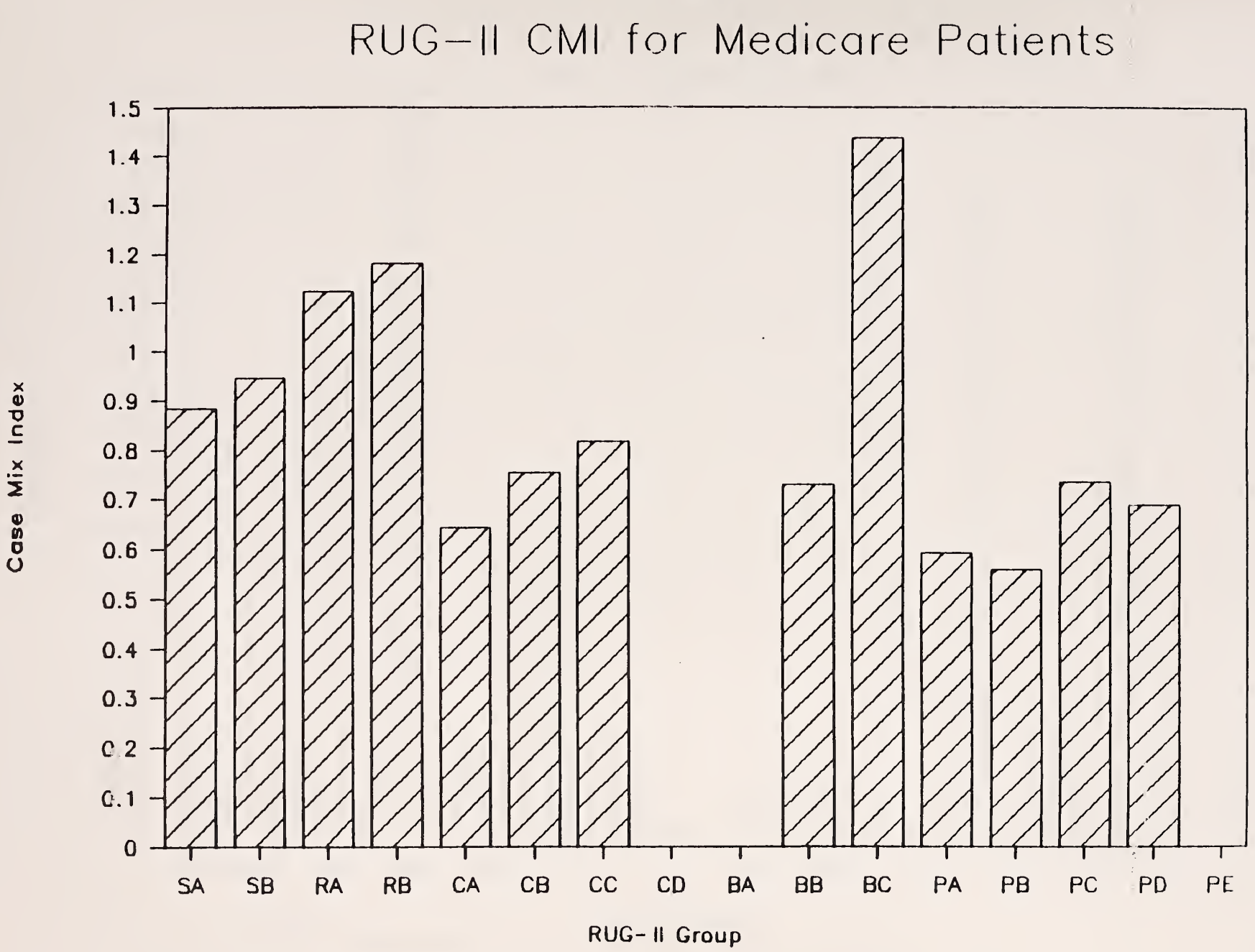

RUG–II CMI for Medicare Patients
Case Mix Index
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SA
SB
RA
RB
CA
CB
CC
CD
BA
BB
BC
PA
PB
PC
PD
PE
RUG-II Group

Figure 5

Distribution of RUG–II Groups

Medicare vs. New York State

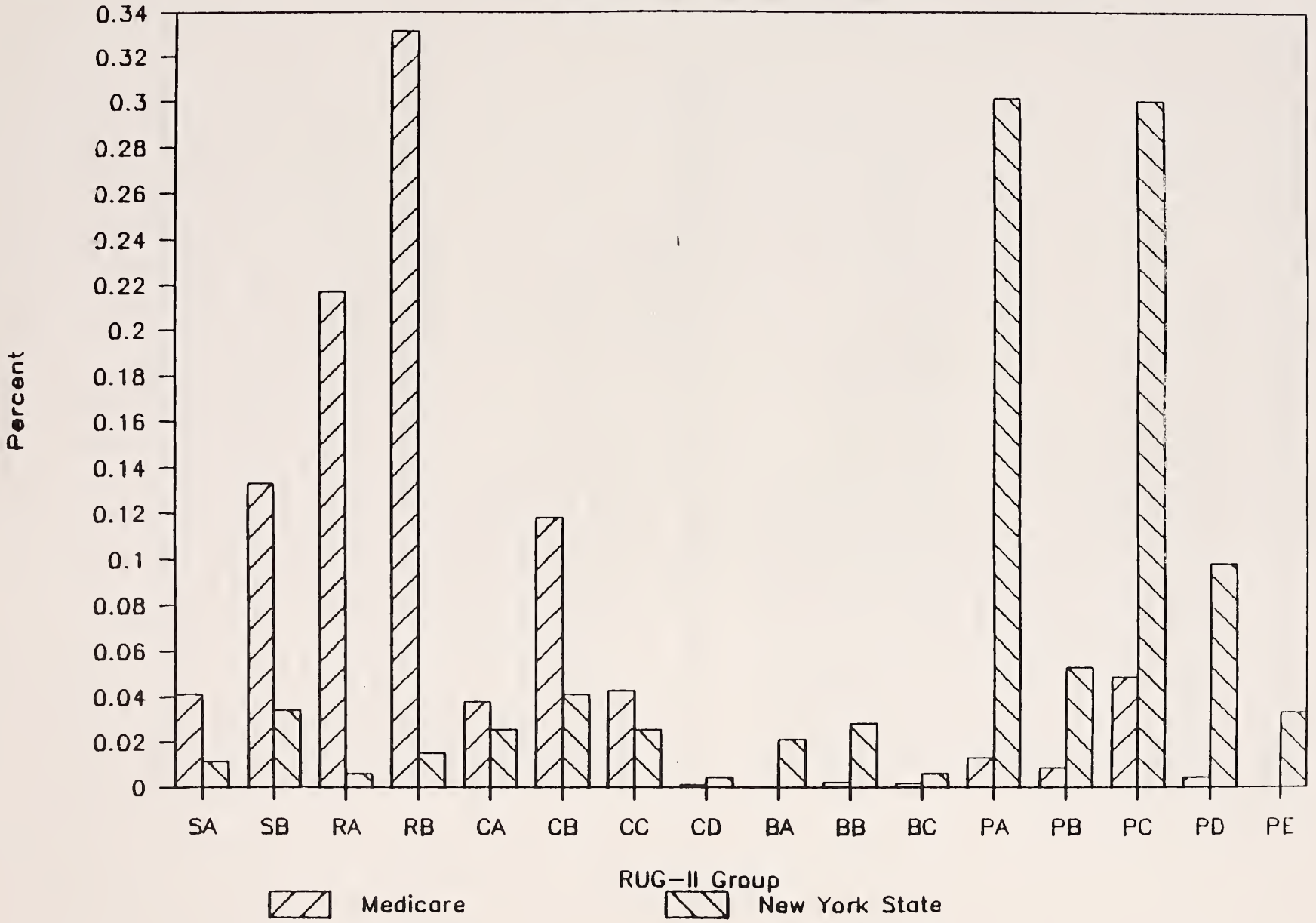
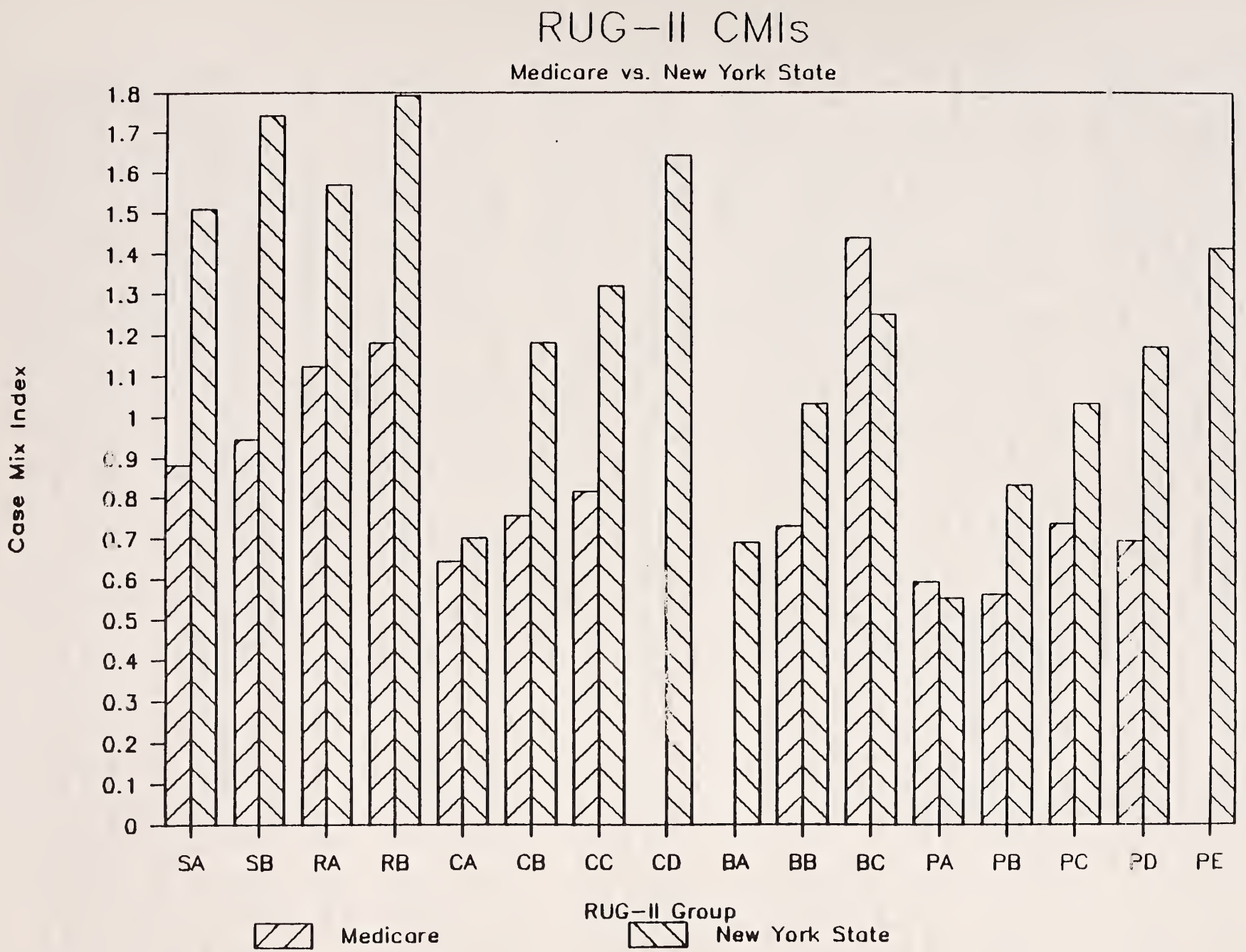


Figure 6


RUG-II CMIs
Medicare vs. New York State
Case Mix Index
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SA
SB
RA
RB
CA
CB
CC
CD
BA
BB
BC
PA
PB
PC
PD
PE
RUG-II Group
Medicare
New York State

sample - CD, BA, and PE. Since each group - New York State and Medicare -- has been adjusted to an average case mix of 1.0, yet they have different overall intensities, one should only evaluate the pattern and not the absolute values of the contrasted Case Mix Indexes. However, in either sample, the same general pattern of case mix indexes is seen: increasing ADL dependencies is allied with increasing cost (the "sawtooth" pattern), and higher costs are seen for the first three hierarchy groups ("SA" through "CD").

When applied to the Medicare patients, the RUG-II system, unmodified except for removing the requirement of a restorative goal for rehabilitation (we assumed that most rehabilitation performed on patients funded under Medicare would be denoted restorative), achieved 16% variance reduction for total cost, 32% for auxiliary cost. For comparison, the RUG-II system applied to the New York State sample of all nursing home residents achieved 53% explanation of total cost. However, as much of the variance explanation in the New York result was associated with custodial care patients at the Intermediate Care Level (ICF) -- denoted Health Related Facilities in New York State -- we also evaluated the RUG-II system excluding the reduced physical functioning patients. For this set of patients, more similar to the Medicare population, the RUG-II system achieved a 30% variance explanation of total cost.

The RUG-II system, even unmodified, was therefore one of the individually best explainers of differences in resource cost, but it was less effective for the Medicare population than for nursing home residents in general. Much of the variance explanation seen resulted from the identification of the rehabilitation patients in the RUG-II system by their receipt of a weekly average of more than 30 minutes per day of special therapies.

For Medicare patients, the RUG-II system was inferior to more direct measures of (auxiliary) resource use. This fact, along with the realization that many more patients are classified into the "Rehabilitation" hierarchy (54% for Medicare, compared with 3% for the New York State nursing home population), led us to expect that there was excellent potential to improve the RUG-II system for this type of resident.

IV.C Development of Resource Utilization Groups for Medicare

The development of a per-diem classification system proceeded in a pair of parallel but related thrusts. First, we carefully considered the appropriateness of the RUG-II system for classifying Medicare patients. If appropriate, either intact or modified, having a common system for all patients in nursing homes--Medicare and others -- would assist in reimbursement, regulation, and facility management. In considering revisions, it was expected that the classifications involved with rehabilitation patients would be those most likely to be affected. The results of applying the RUG-II system to Medicare patients could also be contrasted to the results on all patients in the New York State

(RUG-II) study as well as to New York Medicare patients. This thrust has lead to two possible systems, both revisions of the basic RUG-II system developed for all nursing home patients. Second, we began anew to consider the development of a classification system, focusing particularly upon the identification of patients with admissions for rehabilitation and medical problems. This has lead us to the "Hierarchy of Expected Rehabilitation" which we discuss in a later section. A key element in understanding the differences between these systems is to identify the role of measures of rehabilitation services actual provided to the patient. The first two RUG-II based systems identify rehabilitation patients by the provision of care; the third attempts to predict the need for such care.

IV.C.1 Resource Utilization Groups - Title 18 Classification System (RUG-T18)

The first system, Resource Utilization Groups - Title 18 (RUG-T18), is displayed in Figure 7. A hierarchy of patient types separates patients into one of five categories: Heavy Rehabilitation (Rehab), Special Care (Special), Clinically Complex (Complex), Severe Behavioral (Behavior), and Reduced Physical Functioning (Physical). The criteria used for these groups are given in Table 13; they are virtually the same as those for the RUG-II hierarchy. The only difference affects the definitions of the Rehabilitation group. Thereafter, splits are made of all major groups as in the RUG-II system; new splits divide up the rehabilitation group.

For the major Rehabilitation group, the only difference in definition is that the goal of rehabilitation does not restrict entrance into this group; in the RUG-T18 system the Rehabilitation group contains both maintenance and restoration rehabilitation patients. The criterion used to identify rehabilitation patients remains the same -- an average of 30 minutes or more of rehabilitation (physical, occupational, and speech therapy, and social work) per day -- as does the criteria for the other major patient categories.

The major new development in the RUG-T18 system is in the subdivision of the Rehabilitation category, where patients are split into one of three groups according to the number (one or fewer, two, or three) of the three types of rehabilitation treatments (Physical Therapy (PT), Occupational Therapy (OT), and Speech Therapy (ST)) they receive for an average of more than 30 minutes per day. The use of these therapies was almost always sequential: PT, then OT, then ST. In 92% of all the cases where one therapy was given it was PT, in 90% of the cases where two therapies were given they were PT and OT. These three rehabilitation groups and the other four hierarchy groups are each further split by a measure of ADL dependencies, the ADL index displayed in Table 14. In total, twenty RUG-T18 groups are produced.

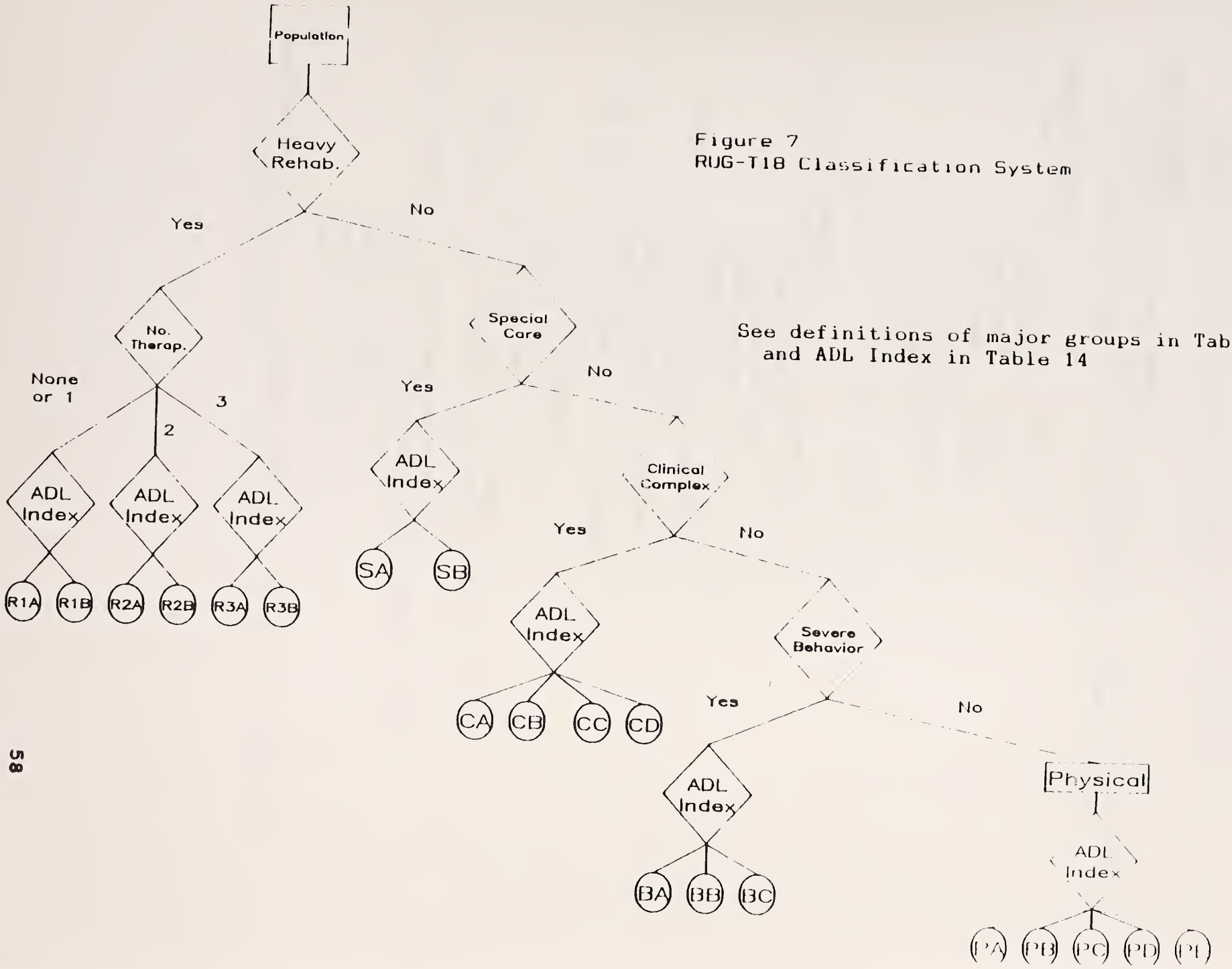


Figure 7
RUG-T18 Classification System

See definitions of major groups in Table 13 and ADL Index in Table 14

Table 13
Criteria for classifying patients into RUG-T18 groups

Major Groups

Heavy Rehabilitation (Rehab):
Total Physical, Occupation and Speech Therapy time in excess of an average of 30 minutes per day over one week

Special Care:
Any of the following conditions:
- Comatose
- Nasogastric feeding
- Parenteral feeding
- Quadriplegia
- Multiple Sclerosis
- Stage 4 decubiti
- Suctioning

AND ADL Index of 5 or more

Clinically Complex:
Any of the folowing treatments:
- Oxygen therapy
- Wound/lesion care
- Chemotherapy
- Transfusion

OR any of the following diagnoses:
- Cerebral Palsy
- Urinary tract infection
- Hemiplegia

OR any of the following conditions:
- Dehydration
- Internal bleeding
- Terminally Ill
- Stasis Ulcer

OR one or more MD visit per week
OR Special care patient with ADL Index of 3 or 4

Severe Behavioral Problem (Behavioral):
Any of the following problems at the severe level:
- Physical aggression
- Verbal abuse
- Regressive behavior
- Hallucinations

Reduced Physical Functioning (Physical): those not classified in any of the above

Table 14
Construction of RUG ADL Index

Formula:

ADL Index = EATING + TOILETING + TRANSFER

(Range = 3 to 10)

where:

EATING (process of getting food to any means from receptacle into body)

= 1 Independent or minimal supervision/assistance
2 Continuous one-to-one supervision and may occasionally require help with eating
3 Totally fed by hand
4 Tube or parenterally fed

TOILETING (process of getting to and from toilet, transferring on and off toilet, cleansing self, and adjusting clothes)

= 1 Independent or minimal supervision/assistance
2 Continuous one-to-one supervision/assistance to total assistance with toileting, or incontinent-does not use toilet
3 Incontinent, but toileted on a regular basis

TRANSFERRING (process of moving between positions, to and from bed, chair, standing)

= 1 Independent or minimal supervision/assistance
2 Continuous supervision or human assistance of one other person
3 Continuous assistance of two or more persons, or bedfast

Splits of major groups are based on two variables:

Number of therapies counts the number of different types of therapies (PT, OT, ST) that are given for more than an average of 30 minutes per day.

ADL Index, ranging from 3-10, scores three ADL functional levels (see Table 14)

Definitions of Groups:

RUG-T18 Group	Major Group	No. Therapies	ADL Index
R1A	Rehabilitation	1	3-4
R1B	Rehabilitation	1	5-10
R2A	Rehabilitation	2	3-4
R2B	Rehabilitation	2	5-10
R3A	Rehabilitation	3	3-4
R3B	Rehabilitation	3	5-10
SA	Special Care		5-7
SB	Special Care		8-10
CA	Clinically Complex		3
CB	Clinically Complex		4-6
CC	Clinically Complex		7-8
CD	Clinically Complex		9-10
BA	Behavioral		3
BB	Behavioral		4-7
BC	Behavioral		8-9
PA	Physical		3
PB	Physical		4
PC	Physical		5-7
PD	Physical		8
PE	Physical		9

Extensive analysis showed that differentiating the non-rehabilitation patients on any other variable or combination of variables envisioned would not provide significantly better explanation of resource cost or more homogeneous groups.

Patients are assigned to a single one of the RUG-T18 groups according to their hierarchy, ADL index, and, in the case of rehabilitation patients, the number of therapies they receive intensely. Each group's name is constructed by a first letter representing the major hierarchy group (R, S, C, B, and P -- as with the RUG-II system) and a last letter (of two or three) representing the ADL group. Thus "CA" represent the group of Clinically Complex patients with the lowest ADL Index value (3). For Rehabilitation patients a middle digit represent the number of services: "R2B is the group of Rehabilitation patients receiving two therapies intensively and with higher ADL Index scores (6 or more).

In total, 61% of the Medicare patients fall into the six rehabilitation categories, 15% into the special care, and 17% into the clinically complex (Table 15 and Figure 8). Again, this distribution is markedly different than that seen in the New York State data, documenting the essential differences between Medicare SNF patients and their cohorts in nursing homes.

The RUG-T18 system achieves a variance reduction of 55.5% on the total per-diem cost (nursing plus ancillary) of caring for a Medicare SNF patient, and 9.1% and 79.2% for the nursing and auxiliary components, respectively. These variance explanations are almost the same in each subsample tested: trimmed (dropping four facilities and two waves in two other facilities) and untrimmed; and on either all assessments (with multiple assessments for patients) and only the first (Table 16). The following discussion focuses on the results for the trimmed sample of all assessments.

Table 15 displays the mean and standard deviations of each of the cost variables for each RUG-T18 group. Although these results derive from the sample of all Medicare assessments, almost identical results were obtained when only the first assessment of each patient was used.

Except for single groups with only four observations, the coefficient of variance (CV) for total cost is under 0.45 and always under 0.50 for nursing costs. In the case of auxiliary costs, where the provision of rehabilitation is low yet highly variable, do we see higher coefficient values.

Alternately displayed, Figure 9 shows the mean total cost index and its two components for each of the RUG-T18 groups, where the average cost for the sample is "normalized" to a Case Mix Index (CMI) of 1.0 on the vertical axis. The CMI varies over a 4 to 1 range, from a low of .58 (Physical B) or slightly over half the cost of the average patient, to 2.37 (Rehab R3B). Within each hierarchy classification, resource use and especially nursing cost

Table 15
RUG-T18 CLASSIFICATION SYSTEM
GROUP CHARACTERISTICS

RUG	Number	%	Total Cost mean	Total Cost s.d.	Total Cost CV	Nursing Cost mean	Nursing Cost s.d.	Nursing Cost CV	Auxiliary Cost mean	Auxiliary Cost s.d.	Auxiliary Cost CV
R1A	363	16.0%	4.50	1.31	0.29	2.50	0.96	0.38	2.00	0.89	0.45
R1B	602	26.5%	4.57	1.47	0.32	2.70	1.21	0.45	1.87	0.85	0.45
R2A	125	5.5%	7.06	2.04	0.29	2.70	0.99	0.37	4.36	1.51	0.35
R2B	197	8.7%	7.35	2.07	0.28	3.07	1.28	0.42	4.28	1.42	0.33
R3A	15	0.7%	10.83	3.15	0.29	3.17	1.02	0.32	7.66	2.24	0.29
R3B	72	3.2%	11.20	2.67	0.24	3.45	1.42	0.41	7.75	2.49	0.32
SA	59	2.6%	3.57	1.49	0.42	3.30	1.49	0.45	0.28	0.30	1.07
SB	278	12.2%	3.81	1.54	0.40	3.63	1.47	0.40	0.19	0.31	1.63
CA	79	3.5%	2.95	1.22	0.41	2.50	1.13	0.45	0.45	0.43	0.96
CB	212	9.3%	3.32	1.42	0.43	2.85	1.41	0.49	0.47	0.35	0.74
CC	92	4.0%	3.81	1.65	0.43	3.42	1.61	0.47	0.39	0.54	1.38
CD	0	0.0%	NA	NA	NA	NA	NA	NA	NA	NA	NA
BA	0	0.0%	NA	NA	NA	NA	NA	NA	NA	NA	NA
BB	9	0.4%	2.85	0.96	0.34	2.38	0.70	0.29	0.47	0.35	0.74
BC	4	0.2%	4.78	2.94	0.62	4.58	2.81	0.61	0.19	0.20	1.05
PA	30	1.3%	2.81	1.32	0.45	2.41	1.26	0.52	0.49	0.40	0.82
PB	21	0.9%	2.74	1.14	0.42	2.27	1.10	0.48	0.47	0.33	0.70
PC	102	4.5%	2.97	1.15	0.39	2.43	1.15	0.47	0.54	0.36	0.67
PD	12	0.5%	3.33	1.46	0.44	2.94	1.55	0.53	0.39	0.32	0.82
PE	0	0.0%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tot:	2272	100.0%	4.74	2.40	0.51	2.88	1.32	0.46	1.87	1.99	1.06
VARIANCE EXPLAN:			55.5%			9.1%			77.3%		

Figure 8

RUG-T18 CLASSIFICATION SYSTEM

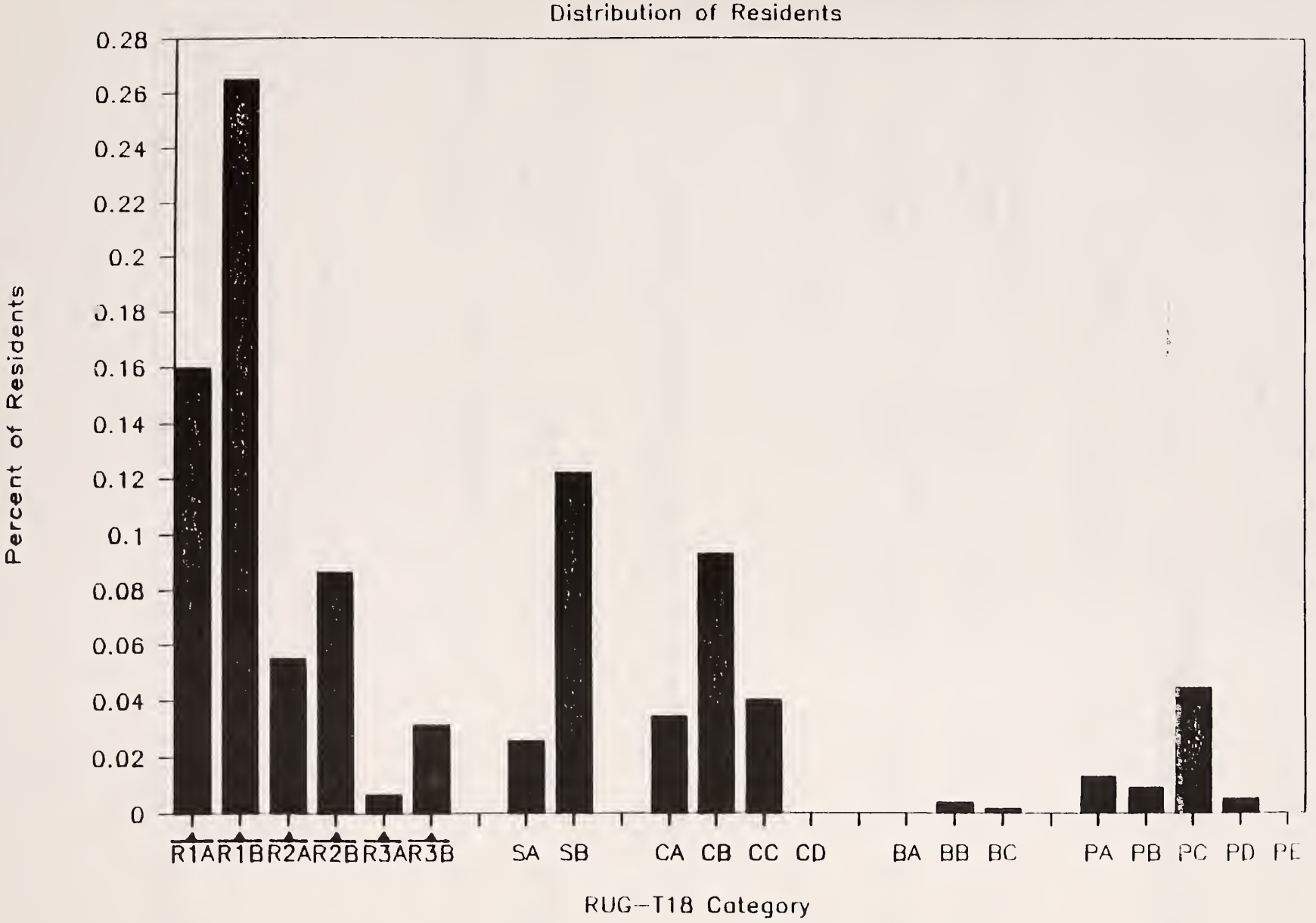
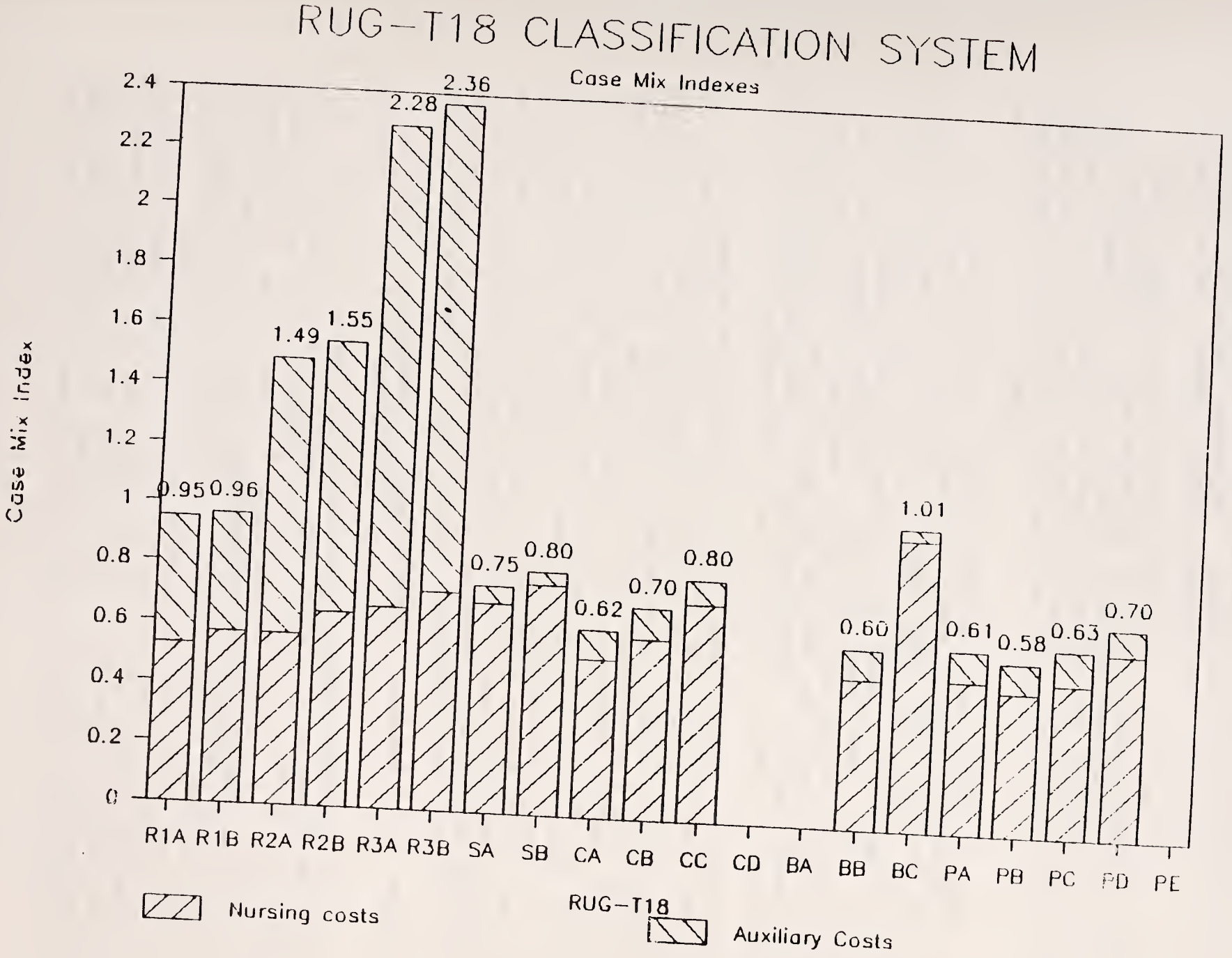


Table 16
Variance reductions of RUG-T18, RUG-T18A and RUG-HER systems
Summary of results

Sample	Number	Variance Reduction in Cost: Total	Nursing	Auxiliary
Resource Utilization Groups - Title 18 (RUG-T18)				
Medicare Assessments				
Untrimmed	2564	50.42%	8.42%	74.63%
Trimmed	2272	55.45%	9.06%	77.29%
Medicare Patients (first assessment)				
Untrimmed	2276	51.03%	8.48%	77.62%
Trimmed	1455	55.80%	9.14%	79.28%
Non-medicare Patients				
Trimmed	705	58.53%	24.54%	85.01%
Alternative Resource Utilization Groups - Title 18 (RUG-T18A)				
Medicare Assessments				
Untrimmed	2564	26.52%	7.24%	48.09%
Trimmed	2272	27.43%	7.63%	47.26%
Medicare Patients (first assessment)				
Trimmed	2276	28.02%	7.51%	49.70%
Resource Utilization Groups - Hierarchy of Expected Rehab. (RUG-HER)				
Medicare Assessments				
Untrimmed	2564	35.50%	13.41%	51.06%
Trimmed	2272	35.61%	14.96%	50.82%

Figure 9


RUG-T18 CLASSIFICATION SYSTEM
Case Mix Indexes
Case Mix Index
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.95 0.96 1.49 1.55 2.28 2.36 0.75 0.80 0.62 0.70 0.80 0.60 1.01 0.61 0.58 0.63 0.70
R1A R1B R2A R2B R3A R3B SA SB CA CB CC CD BA BB BC PA PB PC PD PE
RUG-T18
Nursing costs
Auxiliary Costs

appropriately increases with the level of ADL dependency (i.e., increasing ADL Index) and for the rehabilitation category with an increasing number of therapies. In only one case is this increase not seen -- PB -- where a small group size is involved.

Aside from the difference in defining and classifying rehabilitation patients, the majority of the system, dealing however with a minority of the patients, remains the same as the RUG-II system. In particular, we have maintained the same splits of the remaining four hierarchy groups by the ADL index and have included groups even though they contained few patients, and in three cases no patients, of the sample.

The evaluation of total nursing cost masks in part our understanding of its components. Table 17 and, in graphic form, Figure 10 display the mean minutes per day (for the day and evening shifts) for each of three type of staff: registered nurses, licensed practical nurses, and aides. Aide time, which is also the largest component both by time and cost, is best predicted by ADLs -- as seen by the sawtooth pattern in each major hierarchy group. Nurse times (RN and LPN) are substantially lower but more constant over all patient groups, although these times are lower for the hierarchy group of reduced physical functioning.

For reasons we describe in more detail below, the RUG-T18 is our recommended choice of a system for classifying Medicare patients in Skilled Nursing Facilities. However, we recognize that this system utilizes a measure of resource consumption--auxiliary time of at least 30 minutes per day and the number of auxiliary treatment services (PT, OT, and Speech Therapy) provided to a patient for more than 30 minutes per day -- as patient characteristics to explain resource use. We discuss in the Section V.A the arguments for and against the use of such variables. It is clear that a substantial portion of the high variance explanation seen, especially for auxiliary cost, derives from employing the same variable "on both sides of the equation," and in such a prominent position at the top of the tree of groups.

IV.C.2 Alternate Classification Systems for Medicare Patients - RUG-T18A and RUG-HER

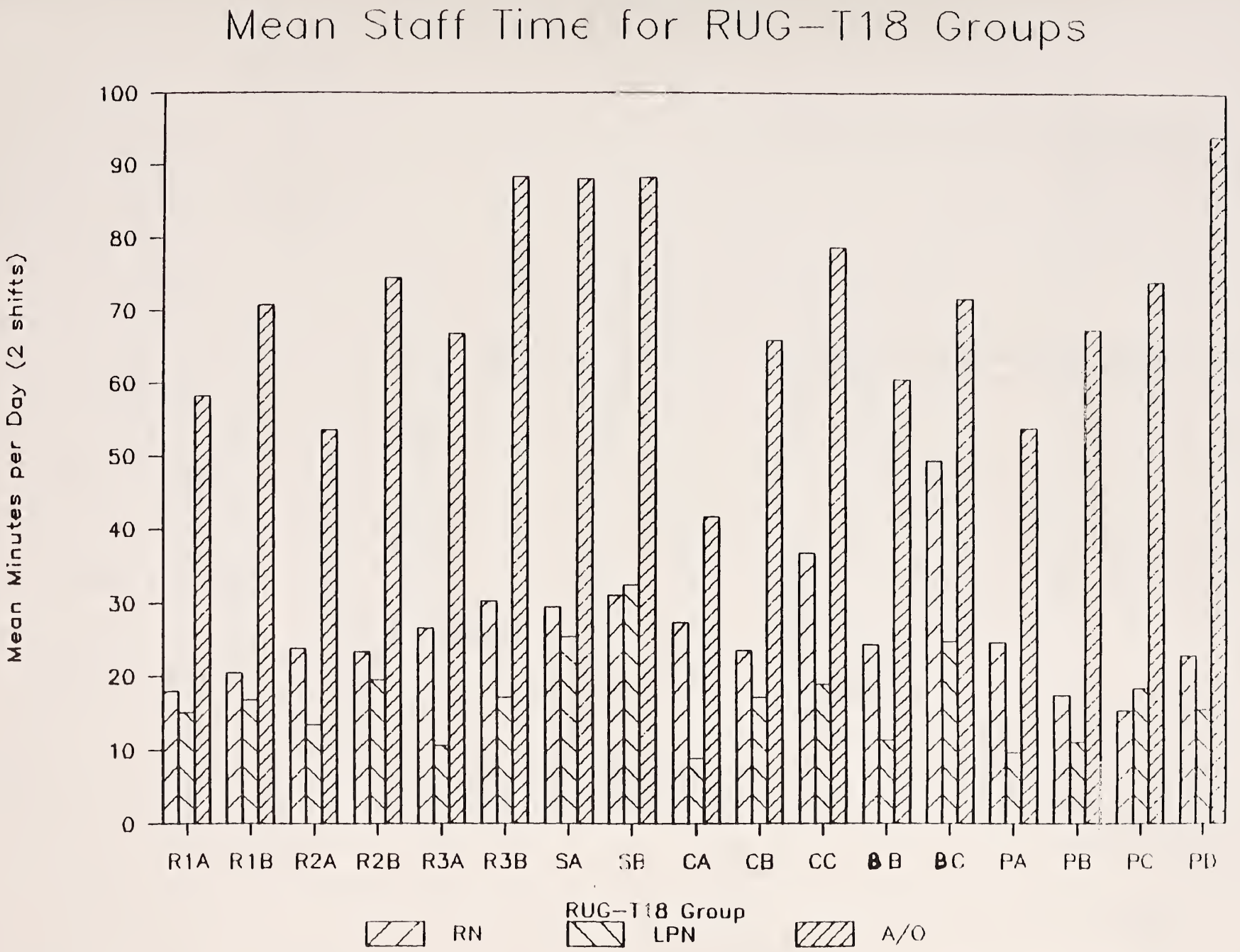
Acknowledging the concerns above, we have experimented with a pair of alternative systems. The first, an alternative RUG-II based system, is one which in our view is inferior, but which represents a more "purist" approach to patient classification. This alternative system, Resource Utilization Groups - Title 18-Alternative Version (RUG-T18A), avoids in part the strong reliance on the provision of therapies in the previously described RUG-T18 system. Structurally, this system differs from the RUG-T18 classifications only in the differentiation of rehabilitation patients (Figure 11, with description in Table 18). Patients are still determined to be rehabilitation patients if they receive more than 30 minutes of therapy a day, but then this category of patients is split by whether their care is mainly associated with

Table 17

Mean Nursing Staff Time for RUG-T18 Groups in Minutes Per Day (2 shifts)

RUG-T18 Group	Registered Nurse		Lic. Practical Nurse		Aide/Orderly	
	Mean	St. Dev	Mean	St. Dev.	Mean	St. Dev.
TOTAL	23.52	28.09	18.48	19.59	70.17	37.39
R1A	18.06	18.92	15.06	16.08	58.25	32.02
R1B	20.58	26.97	16.87	16.46	70.95	34.87
R2A	23.94	22.38	13.55	15.20	53.66	32.00
R2B	23.42	25.81	19.58	20.43	74.63	39.07
R3A	26.67	18.49	10.60	11.57	66.87	43.87
R3B	30.29	26.60	17.26	18.25	88.43	45.00
SA	29.44	24.34	25.44	24.36	88.20	40.71
SB	31.09	32.81	32.47	26.50	88.27	39.82
CA	27.34	28.37	8.86	11.80	41.87	23.62
CB	23.66	31.80	17.18	17.17	65.85	29.67
CC	36.77	46.62	18.89	23.31	78.65	45.93
BB	24.33	30.68	11.44	11.41	60.56	42.90
BC	49.25	37.25	24.75	27.87	71.75	80.97
PA	24.73	34.38	9.63	9.96	53.73	27.61
PB	17.48	22.54	11.14	11.54	67.29	42.51
PC	15.38	18.58	18.48	18.65	74.06	30.92
PD	23.00	30.53	15.50	19.61	94.00	36.38

Figure 10


Mean Staff Time for RUG-T18 Groups
Mean Minutes per Day (2 shifts)
100
90
80
70
60
50
40
30
20
10
0
R1A R1B R2A R2B R3A R3B SA SB CA CB CC BB BC PA PB PC PD
RUG-T18 Group
RN
LPN
A/O

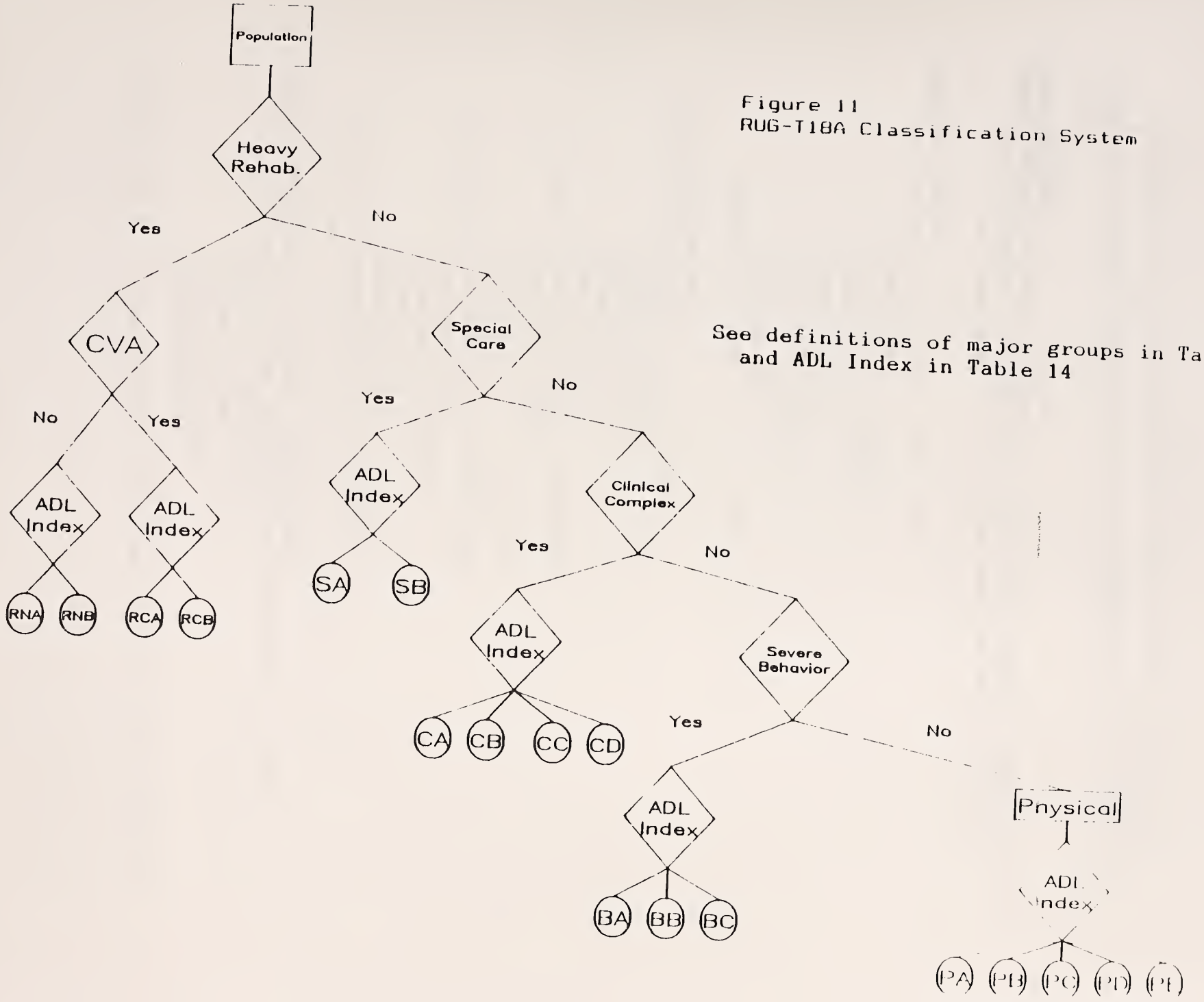


Figure 11
RUG-T18A Classification System

See definitions of major groups in Table 1
and ADL Index in Table 14

Table 18
Criteria for classifying patients into RUG-T18A groups

Criteria for major categories are the same as for the RUG-T18 system:

Major Groups

Heavy Rehabilitation (Rehab):
Total Physical, Occupation and Speech Therapy time in excess of an average of 30 minutes per day over one week

Special Care:
Any of the following conditions:
- Comatose
- Nasogastric feeding
- Parenteral feeding
- Quadriplegia
- Multiple Sclerosis
- Stage 4 decubiti
- Suctioning

AND ADL Index of 5 or more

Clinically Complex:
Any of the folowing treatments:
- Oxygen therapy
- Wound/lesion care
- Chemotherapy
- Transfusion

OR any of the following diagnoses:
- Cerebral Palsy
- Urinary tract infection
- Hemiplegia

OR any of the following conditions:
- Dehydration
- Internal bleeding
- Terminally Ill
- Stasis Ulcer

OR one or more MD visit per week
OR Special care patient with ADL Index of 3 or 4

Severe Behavioral Problem (Behavioral):
Any of the following problems at the severe level:
- Physical aggression
- Verbal abuse
- Regressive behavior
- Hallucinations

Reduced Physical Functioning (Physical): those not classified in any of the above

the after effects of a cerebrovascular accident (CVA), rather than on the count of types of therapies received. Non-CVA patients use about the same nursing times, but substantially less rehabilitation (See Table 19 and Figure 12). Thereafter, these two rehabilitation groups are themselves each split in two according to the ADL Index.

The entire RUG-T18A system of 18 groups achieves 27.4% variance explanation for total cost, with variance explanations of 7.6% and 47.3% for the nursing and auxiliary cost components, respectively. Figures 12 and 13 display the distributions and case mix indexes for this system, respectively.

A more experimental approach to a classification system for Medicare patients resulted in a third system, one which uses service-oriented variables and in particular the actual provision of rehabilitation in a more limited role. The Hierarchy of Expected Rehabilitation (HER) approaches the problem of predicting which patients will require rehabilitation services while attempting, as with the other systems, to explain simultaneously the two major components of cost -- nursing costs and rehabilitation costs.

The RUG-HER system first breaks out patients, again in a hierarchical approach, into major types (Figure 14). To understand which patient can be expected to received rehabilitation, we first separate out those patients who, even if they have rehabilitatable conditions would not receive such services because of other contravening conditions. Thus we first remove those patients who are terminally ill, for whom intensive rehabilitation is relatively unusual or of low intensity, then those who are so sick that they would be likely unable to withstand rehabilitation exertions. The "sick" patients are those who have a variety of medical conditions including dehydration, hemorrhage, severe pain, etc. A third group contains patients with severe mental or behavioral problems which would interfere with rehabilitation. Patients are considered to be rehabilitation candidates if they have medical problems indicating the need for rehabilitation, yet do not fall into any of these other three major groups. A small residual group then remains, consisting of patients not otherwise classified; most patients in this group require long-term care services. Members of this group manifest conditions such as musculoskeletal weakness, tracheostomies, lack of orientation, ostomies, etc.

Table 20 indicates the specific criteria used to classify patients into the five major categories of the RUG-HER system. These characteristics, along with those used to subdivide these major groups, were chosen similarly to those in the RUG-II and RUG-T18 systems, using a combination of clinical and statistical rationale, along with consideration of issues surrounding possible use for nursing home payment.

Splits of major groups are based on two variables:

Cerebrovascular Accident

ADL Index, ranging from 3-10, scores three ADL functional levels (see Table 14)

Definitions of Groups

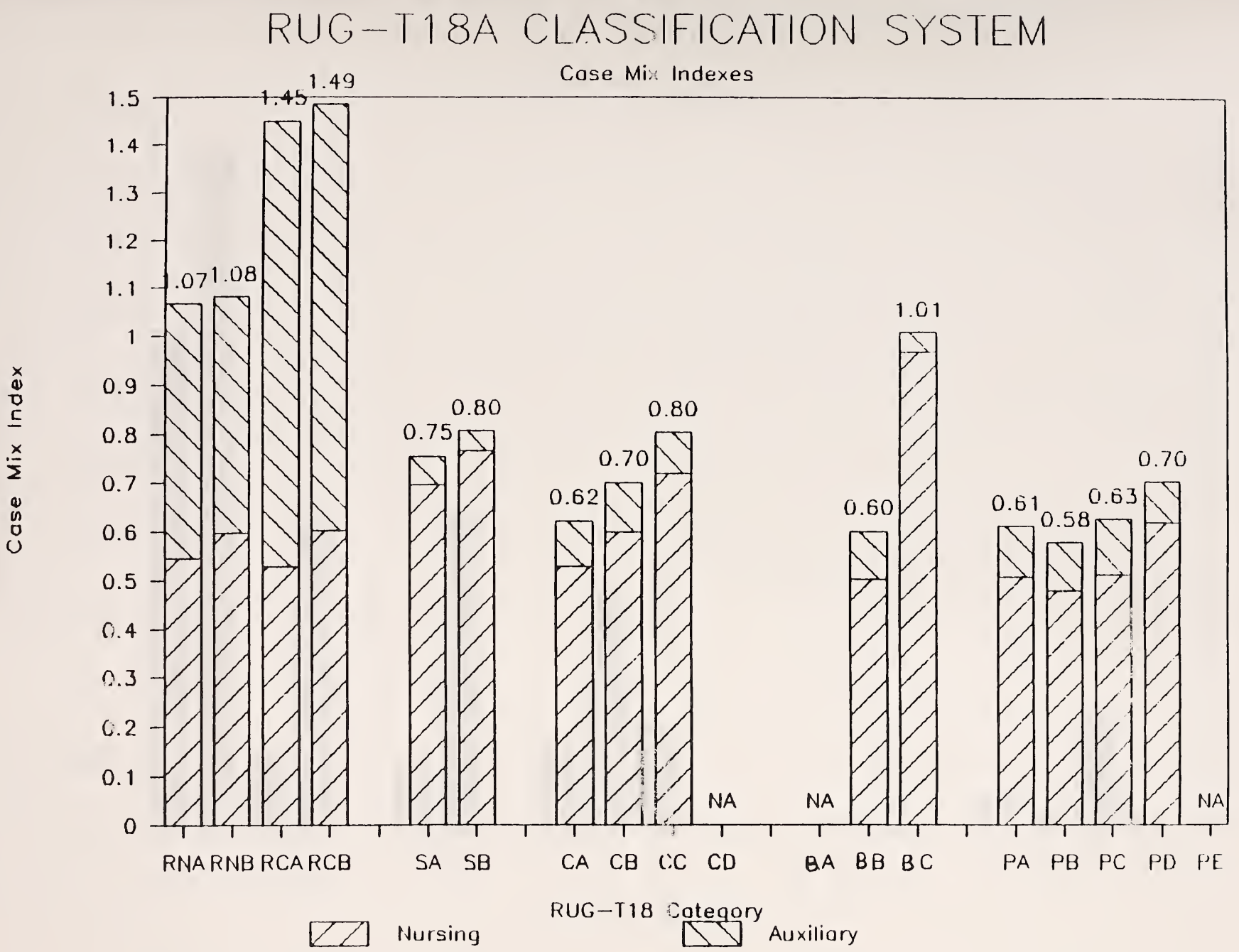
RUG-T18A Group	Major Group	CVA	ADL Index
RNA	Rehabilitation	No	3-4
RNB	Rehabilitation	No	5-10
RCA	Rehabilitation	Yes	3-4
RCB	Rehabilitation	Yes	5-10
SA	Special Care		5-7
SB	Special Care		8-10
CA	Clinically Complex		3
CB	Clinically Complex		4-6
CC	Clinically Complex		7-8
CD	Clinically Complex		9-10
BA	Behavioral		3
BB	Behavioral		4-7
BC	Behavioral		8-9
PA	Physical		3
PB	Physical		4
PC	Physical		5-7
PD	Physical		8
PE	Physical		9

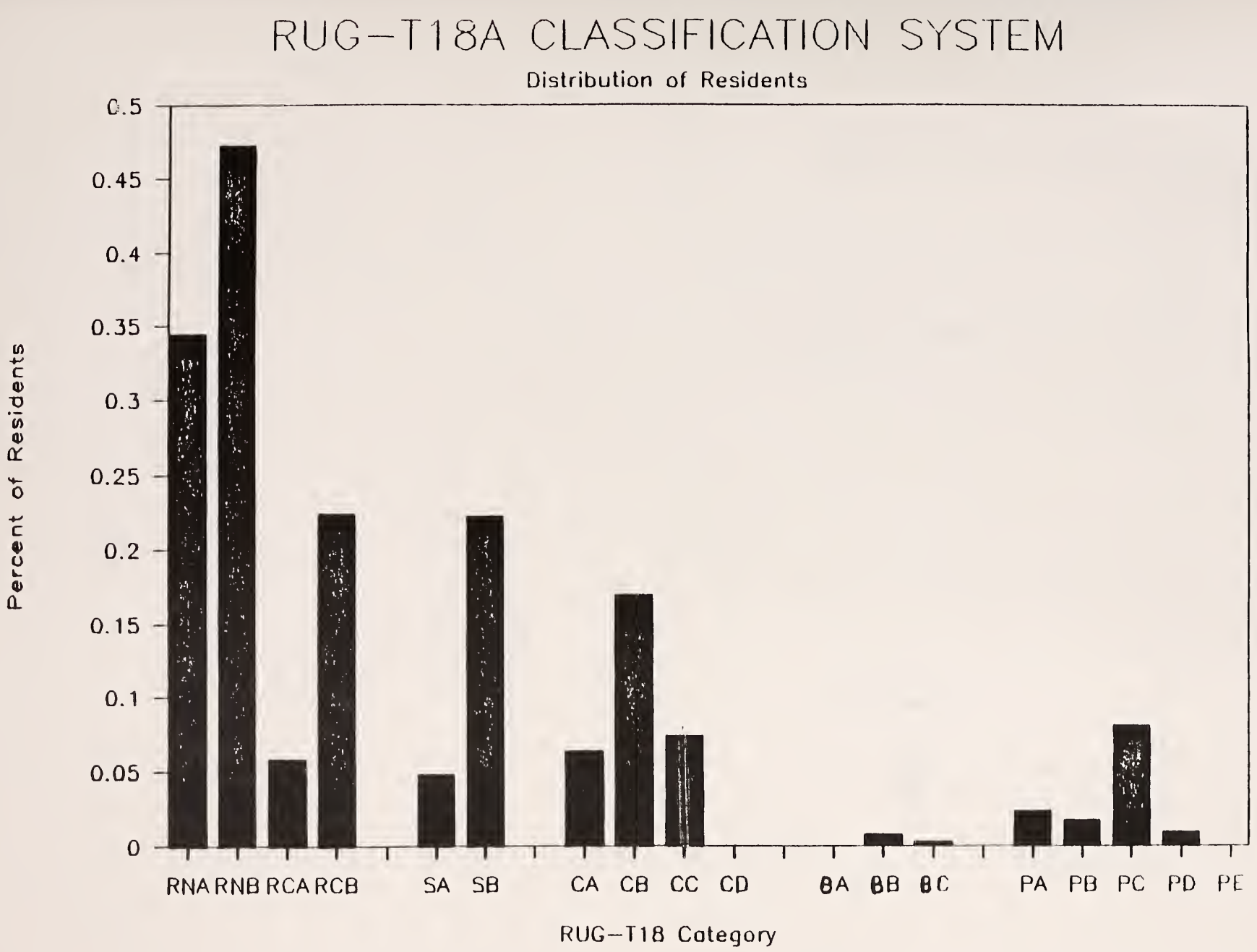
Table 19

RUG-T18A CLASSIFICATION SYSTEM
GROUP CHARACTERISTICS

			Total Cost			Nursing Cost			Auxiliary Cost		
RUG	No.	%	mean	s.d.	CV	mean	s.d.	CV	mean	s.d.	CV
RNA	431	34.5%	5.07	1.94	0.38	2.58	0.99	0.38	2.48	1.49	0.60
RNB	591	47.3%	5.14	2.23	0.43	2.84	1.34	0.47	2.29	1.59	0.69
RCA	72	5.8%	6.87	2.77	0.40	2.50	0.89	0.36	4.37	2.23	0.51
RCB	280	22.4%	7.04	2.99	0.42	2.86	1.10	0.38	4.18	2.54	0.61
SA	59	4.7%	3.57	1.49	0.42	3.30	1.49	0.45	0.28	0.30	1.07
SB	278	22.2%	3.81	1.54	0.40	3.63	1.47	0.40	0.19	0.31	1.63
CA	79	6.3%	2.95	1.22	0.41	2.50	1.13	0.45	0.45	0.43	0.96
CB	212	17.0%	3.32	1.42	0.43	2.85	1.41	0.49	0.47	0.35	0.74
CC	92	7.4%	3.81	1.65	0.43	3.42	1.61	0.47	0.39	0.54	1.38
CD	0	0.0%	NA	NA	NA	NA	NA	NA	NA	NA	NA
BA	0	0.0%	NA	NA	NA	NA	NA	NA	NA	NA	NA
BB	9	0.7%	2.85	0.96	0.34	2.38	0.70	0.29	0.47	0.35	0.74
BC	4	0.3%	4.78	2.94	0.62	4.58	2.81	0.61	0.19	0.20	1.05
PA	30	2.4%	2.91	1.32	0.45	2.41	1.26	0.52	0.49	0.40	0.82
PB	21	1.7%	2.74	1.14	0.42	2.27	1.10	0.48	0.47	0.33	0.70
PC	102	8.2%	2.97	1.15	0.39	2.43	1.15	0.47	0.54	0.36	0.67
PD	12	1.0%	3.33	1.46	0.44	2.94	1.55	0.53	0.39	0.32	0.82
PE	0	0.0%	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOT:	1250	100.0%	4.74	2.40	0.51	2.88	1.32	0.46	1.87	1.99	1.06
VARIANCE EXPLAN:			27.4%			7.6%			47.3%		

Figure 12


RUG-T18A CLASSIFICATION SYSTEM
Case Mix Indexes
Case Mix Index
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1.07
1.08
1.45
1.49
0.75
0.80
0.62
0.70
0.80
NA
NA
0.60
1.01
0.61
0.58
0.63
0.70
NA
RNA RNB RCA RCB SA SB CA CB CC CD BA BB BC PA PB PC PD PE
RUG-T18 Category
Nursing
Auxiliary


RUG-T18A CLASSIFICATION SYSTEM
Distribution of Residents
Percent of Residents
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
RNA RNB RCA RCB SA SB CA CB CC CD BA BB BC PA PB PC PD PE
RUG-T18 Category

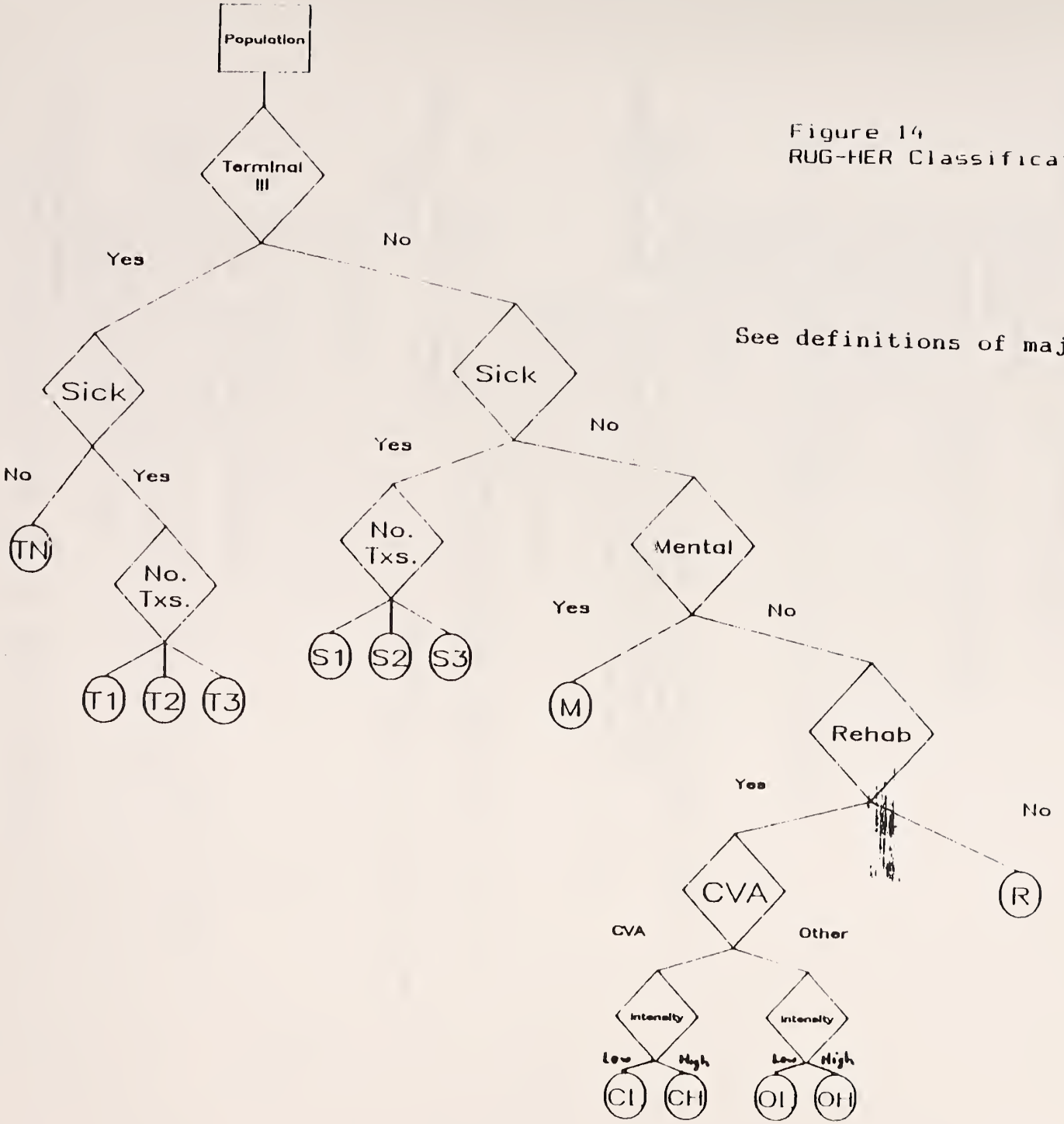


Figure 14
RUG-HER Classification System

See definitions of major groups in Table 20

Table 20
Criteria for classifying patients into RUG-HER groups

Major Groups

Terminal:

Either of the following two conditions:

- Receiving terminal care with an expected remaining lifetime of six months or less
- Principal diagnosis of cancer tumor

Sick:

Any of the following conditions:

- Ascites
- Dehydration
- Dyspnea
- External or internal hemorrhaage
- Projectile vomiting
- Severe pain
- Tarry stools
- Stasis ulcer
- Stage 4 decubitus

OR receiving any of the following treatments:

- Nasogastric feeding
- Suction
- Oxygen therapy
- Ventilator

OR diagnosis in the Skin Disorders group (see Table 3)

OR an ADL Index score of 9 or 10 (see Table 14)

Severe Mental or Behavioral Problem (Mental):

Any of the following problems at the severe level:

- Physical aggression
- Verbal abuse
- Regressive behavior
- Hallucinations

OR diagnosis in the Dementia group (see Table 3) or of Encephalopathy (ICD-9-CM code 348.5)

Rehabilitation (Rehab):

Diagnosis in one of the following diagnostic groups (see Table 3)

- Amputation
- Arthropathy
- CVA
- Hip Fracture
- Late Effects of CVA
- Lower Extremity Fracture
- Other Fractures

OR Orthopaedic aftercare (ICD-9-CM codes V548 or V549)

OR one of the following medical conditions:

- Amputation of limb
- Brace/prosthetic limb
- Speech disorder

Long-Term Care:

Patients who are in none of the earlier groups

Major groups are split using three criteria:

Cerebrovascular Accidents are defined by the diagnostic groups Cerebro-vascular Accident" and "Late Effects of CVA" (see Table 3)

Number of Treatments ("No. Txs") is a count of the number of treatments from the following list:

- Decubitus care
- Skin care
- Turning and positioning
- Splint assistance
- Impaction
- Oxygen therapy
- Pain control
- Nasogastric feeding
- Parenteral feeding
- Transfusion
- Respiratory therapy
- Ventilator
- Tracheostomy care
- Suctioning
- Indwelling catheter

Intensity measures whether all therapies average more than 90 minutes per day: "Low" if <=90 min., "High if >90 min.

Definitions of Groups:

RUG-HER Group	Major Group	No. Txs.	CVA	Intensity
TN	Terminal and Sick			
T1	Terminal	0-2		
T2	Terminal	3-5		
T3	Terminal	6 or more		
S1	Sick	0-2		
S2	Sick	3		
S3	Sick	4 or more		
M	Mental			
CL	Rehabilitation		Yes	Low
CH	Rehabilitation		Yes	High
OL	Rehabilitation		No	Low
OH	Rehabilitation		No	High
R	Long-term			

Beyond these five major categories, a variety of variables are used to distinguish patients. Terminally ill patients are first divided into two groups according to whether they are also "sick" under the definitions above: with a variety of conditions requiring intensive medical care. The two "sick" groups -- "sick" and "terminal and sick" -- are each split according to the number of types of treatments they received, from the list in Table 20 including those for decubiti, impactions, respiratory problems or pain control; oxygen, respiratory, ventilator, therapy, and catheter. Rehabilitation patients are split first into CVA and non-CVA groups, then each into two groups by whether the total time spent on rehabilitation services (including PT, OT, speech therapy, and social work) exceeded 90 minutes per day.

The result of these several splits is a system of 13 groups (Figure 15) which explains 34.5% of the variation in total cost, 13.4% for nursing costs, and 51.0% for rehabilitation costs. The mean cost and its standard deviation for each group and each type of cost is indicated in Table 21. The standardized mean costs (case mix indexes) are displayed as well in Figure 16.

It is clear from the standard deviations and coefficients of variation of rehabilitation cost for each group that the RUG-HER system is not fully adept at distinguishing how much rehabilitation patients actually receive. For some patients, for example, who would appear to be quite sick or terminally ill, significant amounts of rehabilitation are often still given. Use of the RUG-HER system therefor represents a more prescriptive attempt at understanding resource use -- and particularly use of rehabilitative services. In addition, it was surprising that the ADLs did not play a direct role in classifying patients; the combination of the type of patient and numbers of treatments was superior in power to measures of physical functionality.

In total, we found three candidates for per-diem systems to classify Medicare patients for the purpose of reimbursement. From a statistical point of view, the RUG-T18 system achieves the highest variance reductions (except for the nursing costs, in which the RUG-HER system is slightly superior). However, the choice of a system needs to be made on more broad criteria than simply variance explanation. We discuss these issues in greater detail in Section V.A.

IV.D Analysis of the New York State Database using RUG-T18

The availability of a patient classification system allows us to compare accurately the Medicare population and other residents in nursing homes. Previous comparisons by others have been made on individual patient characteristics, in a manner similar to that used in Section IV.A of this report. However, such comparisons do not assure the heterogeneity of the populations for the purposes of reimbursement, as to accomplish this we need to know which characteristics are related directly to resource use. The RUG-T18 system was used here to make a more accurate comparison than had

Table 21
RUG-HER Classification System
group characteristics

			Total			Nursing			Auxiliary		
HER	Num.	%	Mean	S.D.	CV	Mean	S.D.	CV	Mean	S.D.	CV
Term N	106	4.1%	3.57	1.52	0.43	2.57	1.06	0.41	1.00	1.17	1.17
Tm.S-1	119	4.6%	4.33	2.29	0.53	3.38	1.72	0.51	0.94	1.55	1.65
Tm.S-2	103	4.0%	4.54	2.01	0.44	4.07	1.83	0.45	0.47	0.76	1.62
Tm.S-3	14	0.5%	6.82	4.20	0.62	5.94	3.13	0.53	0.88	1.23	1.40
Sick-1	412	16.1%	4.33	1.96	0.45	2.92	1.19	0.41	1.41	1.49	1.06
Sick-2	185	7.2%	4.78	2.06	0.43	3.51	1.35	0.38	1.26	1.61	1.28
Sick-3	91	3.5%	4.75	2.27	0.48	3.92	1.58	0.40	0.83	1.53	1.84
Mental	90	3.5%	4.08	1.69	0.41	2.73	1.10	0.40	1.35	1.33	0.99
CVA-Lo	164	6.4%	4.25	1.24	0.29	2.56	1.07	0.42	1.68	0.91	0.54
CVA-Hi	186	7.3%	8.75	2.98	0.34	2.93	1.21	0.41	5.82	2.35	0.40
Oth-Lo	770	30.0%	3.86	1.37	0.35	2.50	1.07	0.43	1.36	0.85	0.63
Oth-Hi	193	7.5%	6.96	2.51	0.36	2.68	1.26	0.47	4.29	1.84	0.43
L.term	131	5.1%	3.93	1.71	0.44	2.98	1.43	0.48	0.95	1.09	1.15
Tot:	2564	100.0%	4.71	2.39	0.51	2.90	1.37	0.47	1.81	1.96	1.08
VARIANCE EXPLAN:			34.5%			13.4%			51.0%		

Figure 15

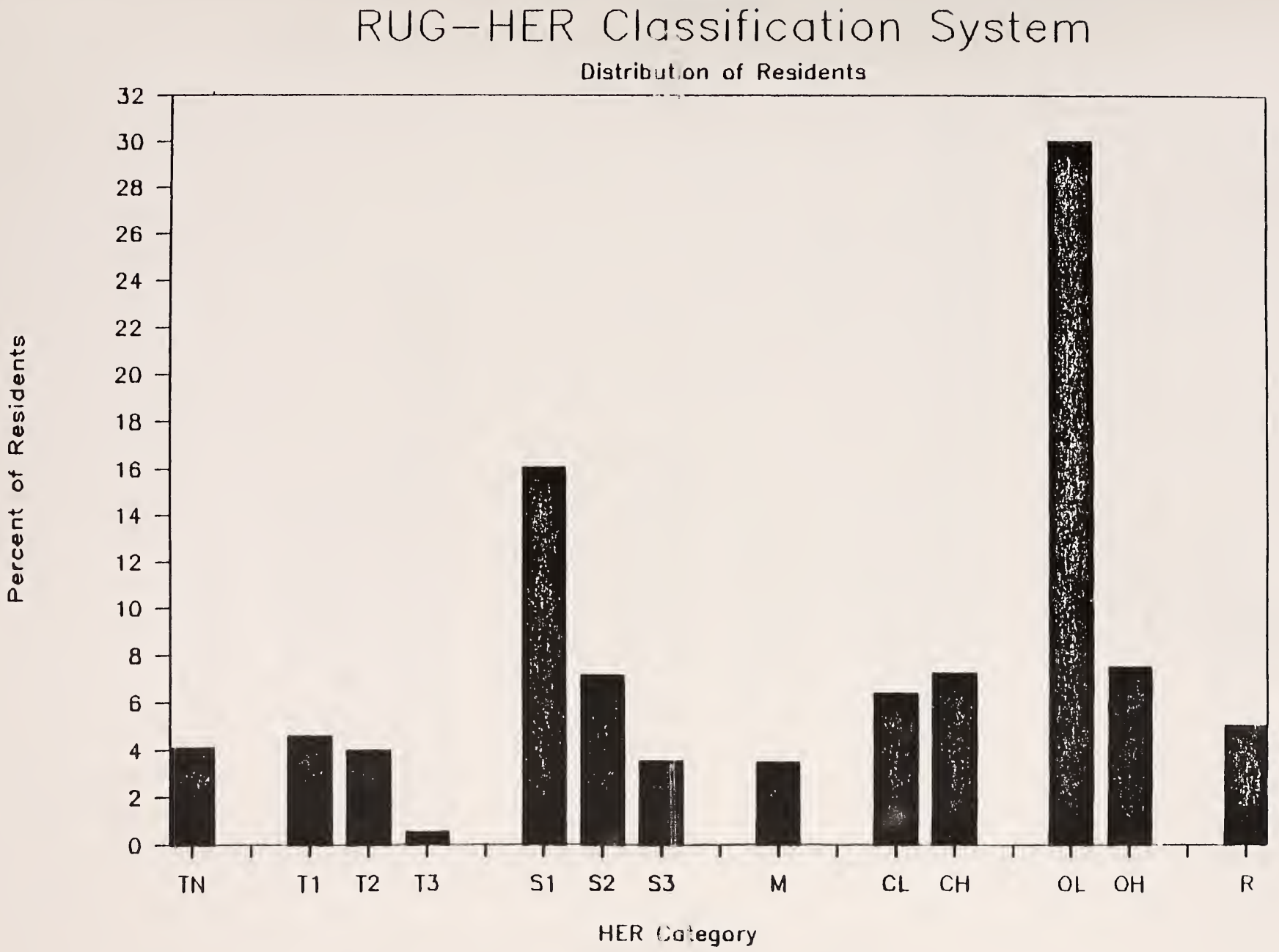
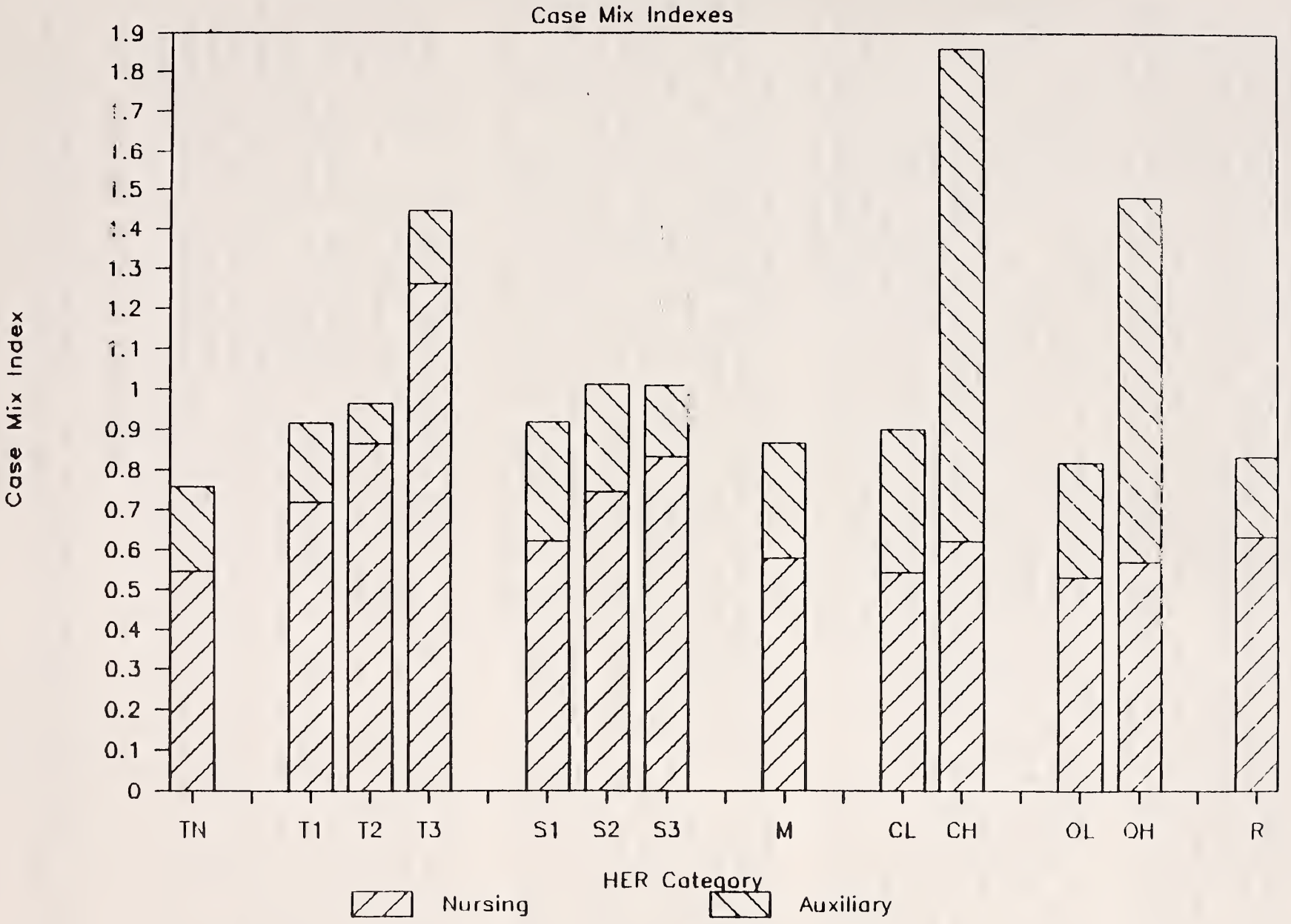

RUG-HER Classification System
Distribution of Residents
Percent of Residents
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
TN
T1
T2
T3
S1
S2
S3
M
CL
CH
OL
OH
R
HER Category

Figure 16

RUG–HER Classification System



previously be possible of Medicare and other nursing home residents. The nursing home population used for reference was that collected in the New York State Case Mix Reimbursement Project, describing 3427 patients in both Intermediate Care and Skilled Nursing Facilities in New York State, with detailed daily nursing times and cost figures collected in the same manner as in this project. We also had available a subset of 80 Medicare patients in this data set, a small population which could be employed for partial validation of the RUG-T18 system.

When the RUG-T18 system was applied to all patients in the NYS database, we achieved a variance reduction of 48.3% in total cost (Table 22). Given the high commonality of the RUG-T18 and RUG-II systems, it is not surprising that this value varies only slightly from the 53% achieved by the RUG-II system on trimmed NYS data. The case mix indexes (CMIs) -- mean total costs for each RUG-T18 group -- in each of the two data sets are shown in Figure 17. It was expected that we would see the RUG-II "sawtooth" pattern with increasing cost within each major hierarchy category. However the impact of the differences associated with increasing ADL dependencies were, as previously discussed, less pronounced in the Medicare sample.

While the variance explanations and case mix indexes were similar across these two data sets, the distributions of patients across the RUG-T18 groups differed significantly. Figure 18 displays the distribution of the Medicare sample (from this study) on the top against the distribution of the NYS population displayed downward below the central line. To emphasize the relationship, the groups are displayed ordered in increasing (Medicare) case mix index from left to right. One can see that in the New York State sample there is a higher proportion of residents in the lowest (less resource intense) RUG-T18 groups PA, PB, BB, and PC, and many fewer of the most resource-intense rehabilitation groups R2A, R2B, R3A and R3B.

While the spectrum of patients in New York nursing homes--almost all Medicaid and private pay -- are unlike the Medicare population, those who were in fact supported by Medicare were similar to our independent national sample. When the RUG-T18 system was applied to the 80 NY Medicare patients, we achieve a total variance explanation of 48.5% (Table 22). This high value is considered a partial validation of the RUG-T18 system, especially when we take into account that the New York study showed significantly less rehabilitation provided and was designed with less accurate measures of the time involved with individual rehabilitation therapies. Given the small sample size, no comparisons of distributions or case mix indexes were considered reliable.

IV.E Patterns of Care over Time

For a pair of reasons, we examined changes that occur in the cost of a patient's care over the course of the nursing home stay.

Table 22
Variance reduction of RUG-T18 system applied to New York State database

NYS Sample	No.	Nursing Time	Nursing Cost	Total Cost
All Patients	3427	48.4%	47.1%	48.3%
Excluding "Physical" Patients	1615	35.3%	34.1%	35.1%
Medicare only	80	45.4%	52.1%	48.5%

Figure 17

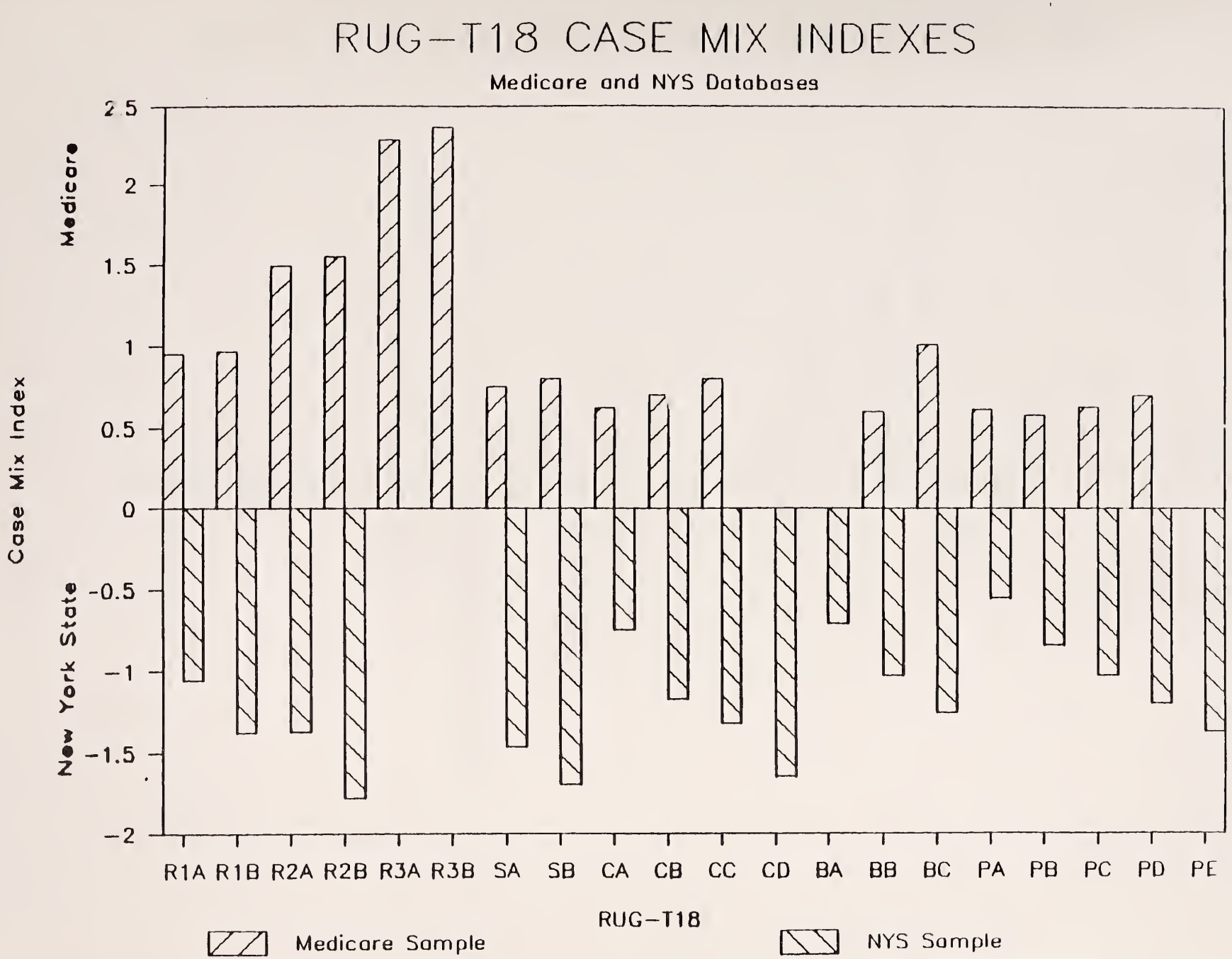
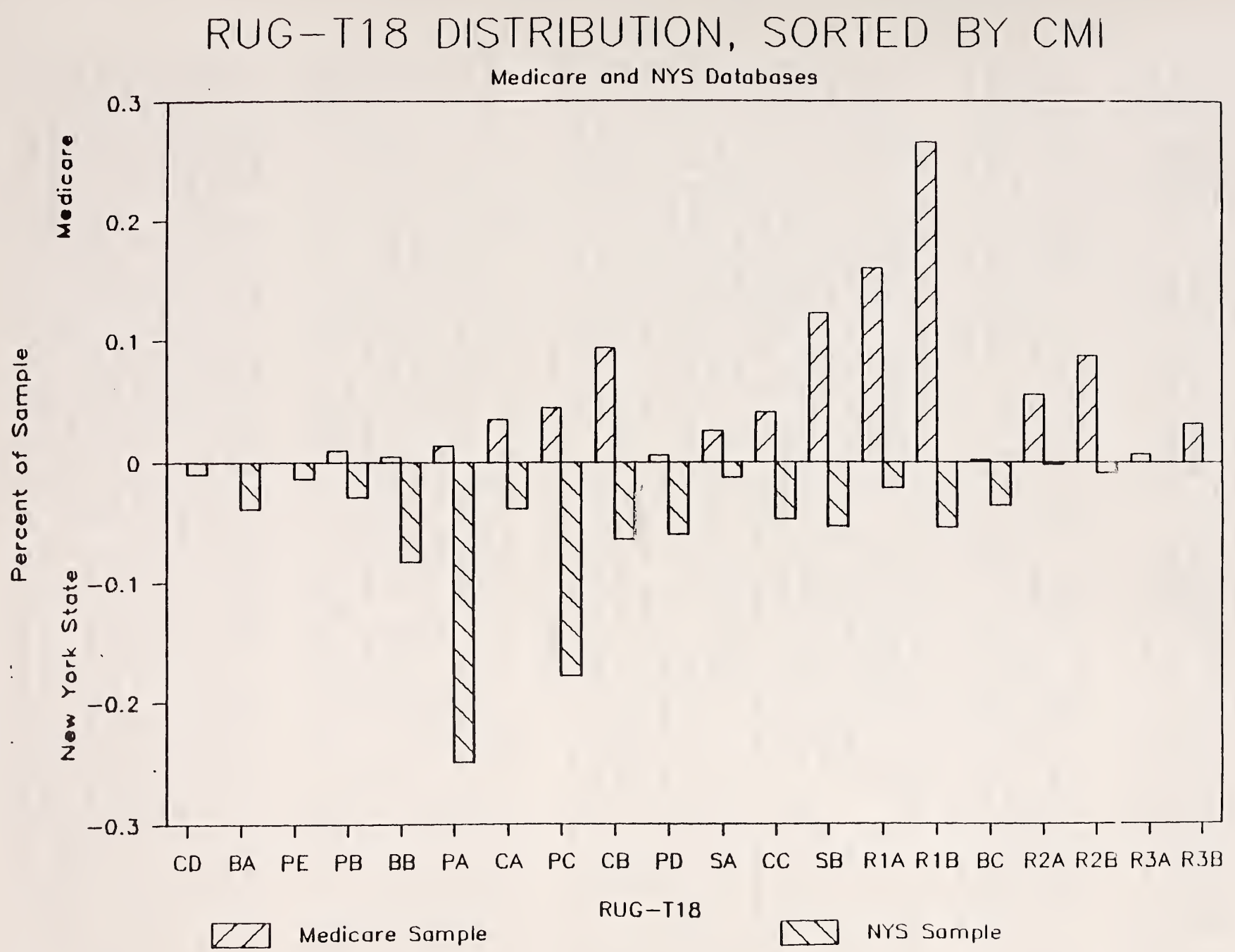

RUG-T18 CASE MIX INDEXES
Medicare and NYS Databases
Medicare
New York State
Case Mix Index
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
R1A R1B R2A R2B R3A R3B SA SB CA CB CC CD BA BB BC PA PB PC PD PE
RUG-T18
Medicare Sample
NYS Sample

Figure 18


RUG-T18 DISTRIBUTION, SORTED BY CMI
Medicare and NYS Databases
Medicare
New York State
Percent of Sample
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
CD BA PE PB BB PA CA PC CB PD SA CC SB R1A R1B BC R2A R2B R3A R3B
RUG-T18
Medicare Sample
NYS Sample

First, if patterns of resource use over patients' stays could be identified, then case costs could be assigned, the first step in developing an case-based case mix system. Second, understanding such patterns would give useful insight into the different costs pertaining to similar patients in different portions of their stay.

To approach the second issue, two variables were defined to indicate stages of the patient's stay. The definitions and portion of the sample falling into each stage are shown in Table 23; the variables STAY1 and STAY2 indicate when the assessment was performed, determined in the number of days since admission. Analysis was performed only for Medicare patients in the sample.

The stage of assessment does relate to the patient's current case mix category. Using STAY1, the breakdown into the RUG-T18 hierarchy is shown in Table 24 (there were too few patients in Behavioral group to subdivide by stage of stay). The major observation to be noted is the significant decrease in patients qualifying for the Rehabilitation group after the third week of stay. As these data are cross-sectional snapshots (although some patients were assessed two or three times), one cannot necessarily infer that patients tend to shift categories. For example, the same results could occur if significant numbers of Rehabilitation patients were discharged before 22 days. One implication of these data is that patients may need to be assessed more than once during their stay as either patients move between categories (see the following section) or are discharged at different times. If assessments are performed during the second or third week, as opposed to the first week, more patients will be classified as Rehabilitation and fewer as Clinically Complex.

The stage of the stay also may have an impact upon on the amount of care provided to the patient. Several variations of this analysis were performed. The first used the average hours of care in each RUG-T18 category for RNs, LPNs, Aides, and therapists for each category of the variable STAY1 and STAY2. This analysis was also pursued displaying actual time against length of stay in scatterplots, although these diagrams are not displayed here. Basically, no pattern emerged, i.e, the amount of care in each RUG-T18 group did not appear to be related to the stage in the stay.

Since we had previously established that the individual facilities provided significantly different levels of care, we next attempted to remove "facility" as a confounding factor by normalizing the care times in each facility. To do this, we calculated the average care time (RN, LPN, Aide, Therapy) per patient day in the facility, the then divided the amount of care time spent on each patient in the facility by this average. The resulting dependent variable has the same distribution as the original, but the mean value was now 1.0. When this normalization was performed for each facility, it followed that each facility had a mean value of 1.0 for each of the personnel categories.

Table 23
Distribution of assessments by day of stay

	Stage	Percentage	Number
STAY1:	1-7 days	24.9%	566
	8-21 days	32.6%	741
	22 days or over	42.5%	965
STAY2:	1-7 days	24.9%	566
	8-14 days	18.0%	408
	15-21 days	14.7%	333
	22-28 days	8.8%	201
	29 days or over	33.6%	764

Table 24
Percentage of patients in hierarchy groups by when assessment was performed

Hierarchy Group	Day of Stay 1-7 days	8-21 days	22+days
Rehabilitation	60.1%	68.0%	44.6%
Special	9.7%	10.5%	21.1%
Complex	20.7%	14.3%	16.6%
Behavioral*			
Physical	9.5%	6.5%	6.6%

---

*Insufficient sample size to split meaningfully into groups.

This normalized time is shown in Table 25, tabulated for stages of stay and for those RUG-T18 groups with more than 20 samples per cell.

The results highlight the impact of stage of the stay. As can be seen, patterns of care fluctuate considerably, even after being normalized for each facility. Across almost every RUG-T18 category, nursing times were higher in the first week, then fluctuated in the remaining stages. Therapy tended to be highest in the middle stage(s). When nursing and therapies are added, the first two weeks of the stay are approximately 5% more expensive than the remaining stay.

Separate analysis of this issue was performed using AUTOGRP. STAY1 and STAY2 were used as potential independent variables at the "bottom of the tree" (i.e., with each of the RUG-T18 groups). The AUTOGRP results also confirmed these findings: it was possible to increase the variance explanation in some of the RUG-T18 groups by up to 3-4% if the group was split using STAY1 or STAY2. Nevertheless, overall, there was little impact of using stage of stay in explaining resource use.

In summary, the stage of the stay plays a small role in the cost of caring for the patient. Patients in their first two weeks of stay tend to be slightly higher in cost than patients later in their stay. This small difference would indicate that a flat payment rate per day for each case mix group would be supportable by the data.

On the other hand, no evidence existed that would allow us to hypothesize a time pattern of care for either the entire sample or for a clinically homogeneous group of patients. In the absence of a strong pattern, it was not possible to construct in a sophisticated manner case-based cost measures to be used in exploring the feasibility of an case- or episode-based case mix measure. We describe in Section IV.G the analyses performed on a more coarsely defined measure of total case cost.

IV.F Longitudinal Analysis of Patients

A major issue in developing a reimbursement system is the frequency at which assessments need to be made. In part this determination is related to the rapidity at which patient move between case mix and thus reimbursement categories. This longitudinal analysis of patient movements between RUG-T18 groups considers only Medicare patients that had more than one assessment during their stay. The assessment timing was as follows in each facility: first assessment at time t; second assessment at (t + 7) days; third assessment at time (t + 35) days. In the trimmed data set, our sample included 657 patients with two assessments and 186 patients with three assessments.

The first part of the analysis examines the distribution of patients by RUG-T18 category from one assessment to the next.

Table 25
Normalized care times by stage of stay and selected RUG-T18 categories

All Patients

Stage	Nursing	Therapy
1-7 days	1.07	.98
8-14	.96	1.09
15-21	.97	.99
22-28	1.01	1.02
29 days or over	.98	.96

Selected RUG-T18 Categories

	Mean Nursing Times			Mean Therapy Times		
	Day of Stay			Day of Stay		
	1-7	8-21	22 or more	1-7	8-21	22 or more
R1A	.89	.73	.83	.99	1.11	1.11
R1B	1.00	.96	1.01	1.08	1.11	1.07
R2A	.88	.82	.77	2.14	2.02	2.02
R2B	1.10	.94	1.02	1.88	2.12	1.96
R3B	1.10	1.06	.99	3.13	3.23	3.59
SB	1.42	1.21	1.28			
CA	.79	.74	.81			
CB	1.04	.96	.98			
CC	1.16	1.22	1.19			
PC	1.09	.98	.93			

The two parts of Table 26 show reasonably stable distributions of patients across the six most frequent RUG-T18 groups over time. For all patients with two assessments, the major disparities are among the Rehabilitation groups as the patients' functional status changes. The analysis of 186 patients with three assessments appears to show a major decrease in the Rehabilitation category: this is not actually true. While there is some decrease, the percentage of patients in all Rehabilitation groups drops only from 55.5% at assessment 2 to 49.4% at assessment 3 (although not shown, additional patients shift into R2A, R3A and R3B at the last assessment). It should also be noted that the three assessment group is quite biased: in order to receive three assessments, the patient had to have a length of stay of at least 35 days. This explains the higher percentage of patients in Special Care and Clinically complex categories the for the group with three assessment table as compared to all those with two or more assessments.

Similar results are seen if we examine the amount of care provided to the patient at each point of assessment. Table 27 shows the difference in minutes of care per day for patients with two or three assessments. A positive entry indicates that more time was spent when assessment 1 was done as compared to assessment 2 or 3. These differences are small when compared with the mean care times for each group (see, for example, Table 17).

As was the case with the analysis of the previous section, these results indicate no strong trend in the amount of care provided to patients over time. The relatively limited sample, high variability, and relatively small differences do not lead to a conclusion that there is a statistically significant difference.

The third approach to understanding changes over time is to examine the movement of individual patients between RUG-T18 groups across multiple assessments. Thus this analysis evaluates both the stability of the classification as well as the impact of assessing the patient at different parts of the stay (<u>viz.</u> it indicates the best stage of the stay to perform the assessment). The two transition matrices shown in Table 28 display transition from Assessment 1 to Assessment 2 (i.e., over a period of six days) and from Assessment 1 to Assessment 3 (a period of 35 days). For example, 62.5% of patients who at Assessment 1 would be classified into groups R1A remain in R1A six days later at Assessment 2, 18.1% have not moved to R1B, etc. Only the five most frequent RUG-T18 groups are shown due to sample size limitations.

The classification appears to be very stable over a one week period. The largest proportion of transition out of groups move patients between the Physical and Rehabilitation groups. Since the requirements for being in the Rehab group were defined in terms of the amount of Rehabilitation services provided in the past week, this indicates variability from week to week in patients' receipt of rehabilitation services. It follows that stability could be improved employing total rehabilitation time

over a period longer than one week as the qualifier for the Rehabilitation group.

The transition matrix between the first and third assessments, while limited due to the sample size, tends to support the findings noted above. The Rehabilitation groups and Special care groups tend to be stable, with some transition between the Physical and Rehab groups. The clinically complex groups tend to be the least stable. The clinically complex category includes an number of medical conditions and nursing treatments that typically are limited in duration and thus would be expected to be more dependent upon when the assessment was performed.

In summary, the above tables lead to the conclusion that the groups are quite stable. Thus, selecting a single point in time to perform the assessment and basing the payment upon a single assessment appears to be quite feasible. In proceeding in this direction, the definition for the Rehabilitation category should be changed to the therapy time over a period longer than a week. Among all the groups, the Clinically complex are the most unstable. The picture that emerges is largely one of patients leaving the Clinically Complex groups to go to the Rehabilitation or Physical groups, rather than major transitions into the Clinically complex group. A broadening of the definition of rehabilitation, to cover a multi-week period, would likely reduce the number of patients classified as Clinically Complex (as more would be classified as Rehabilitation). The broadened definition would also likely reclassify some of the Rehabilitation patients into the Physical categories.

IV.G Feasibility of a Per-case Medicare Classification System

The results discussed to this point did not encourage the feasibility of developing a per-case classification system for Medicare: there were no discernible patterns of resource use over time (Section IV.E) and high variability was seen in the length of Medicare-covered stay (Section IV.A.). However, it was possible that length of stay could be predicted accurately or that the derived RUG-T18 system would predict well an estimate of total case cost. We pursued each of these two possibilities.

Using length of stay (for those patients who were reported as finishing their Medicare stay) as the dependent variable to be explained, we used AUTOGRP to identify potential characteristics which could be used to predict long or short stays. Table 29 displays a few of the more important variables tested. The ADL Index was surprisingly well correlated with length of stay: patients with index scores of seven or more had average stays close to fifty percent longer stays than those with index scores of three or four, and the length of stay increased monotonically with increasing index (not shown). Partially for this reason, the

Table 26
Distribution of patients across six RUG-T18 Groups
by assessment

For patients with two or more assessments (n=657)

RUG-T18 Group	Assessment 1	Assessment 2
R1A	11.6%	16.1%
R1B	29.7%	26.6%
R2B	9.4%	9.0%
SB	13.2%	12.2%
CB	9.5%	6.7%
PC	5.0%	5.2%

For patients with three assessments (n=186)

RUG-T18 Group	Assessment 1	Assessment 2	Assessment 3
R1A	4.6%	9.0%	12.5%
R1B	30.1%	31.0%	17.0%
R2B	9.2%	9.0%	10.8%
SB	22.9%	22.6%	22.2%
CB	11.1%	6.5%	6.8%
PC	5.9%	6.5%	4.5%

Table 27
Difference in minutes of care per day between Assessment 1 and Assessment 2 for five RUG-T18 groups

Assessment 1 RUG-T18 Group	Nursing time	Therapy time
Between Assessment 1 and 2		
R1A	4.9 min/day	-7.7 min/day
R2A	4.2	.4
SB	1.4	
CB	-4.9	
PC	16.4	
Between Assessment 1 and 3		
R1A	9.5 min/day	- .3 min/day
R1B	.4	2.4
SB	-2.9	
CB	10.1	
PC	-8.0	

Table 28
Movement between RUG-T18 Categories

Assessment 1 to Assessment 2

RUG-T18 of Assessment 1	No.	RUG-T18 of Assessment 2 R1A	R1B	SB	CB	PC	Other
R1A	72	62.5%	18.1%	0.0%	4.2%	0.0%	15.3%
R1B	184	13.0%	56.0%	2.2%	3.3%	5.4%	20.1%
SB	82	0.0%	3.7%	86.6%	0.0%	0.0%	9.8%
CB	59	11.9%	15.3%	0.0%	42.4%	11.9%	18.6%
PC	31	6.5%	25.8%	0.0%	9.7%	45.2%	12.9%

Assessment 1 to Assessment 3

RUG-T18 of Assessment 1	No.	RUG-T18 of Assessment 3 R1A	R1B	SB	CB	PC	Other
R1A	7	57.1%	0.0%	0.0%	0.0%	0.0%	42.9%
R1B	46	8.7%	32.6%	4.3%	10.9%	8.7%	34.8%
SB	35	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
CB	17	17.6%	0.0%	0.0%	23.5%	5.9%	52.9%
PC	9	22.2%	11.1%	0.0%	11.1%	22.2%	33.3%

Table 29
Variance reduction of length of stay for selected variables

Variable	Variance Explanation*
ILLNESS	5.9%
ADLSUM	5.5%
RUG-II	6.5%
RUG-T18	7.9%

---

* Performed for patients with reported complete Medicare stays (n=1316)

RUG-II and RUG-T18 (see Table 30) systems also had statistically significant variance explanation of length of stay. However, the variance explanations achieved by patient characteristics were all under 8%; it is unlikely that reimbursement could be based on a classification system with such poor predictive capability.

Although the RUG-T18 system achieved only 8% explanation of length of stay, if this predictive ability augmented its ability to predict daily costs, it was possible that the RUG-T18 system would be usable as an case-based system. As we were unable to identify patterns of care over time, we constructed a surrogate case cost by simply multiplying per-diem costs by length of stay, in effect assuming constant costs throughout a stay. Although this measure is admittedly coarse, it does reproduce in some manners the cost variables used in deriving the DRGs. The DRGs were constructed initially to explain length of stay and later validated on billed costs, a major portion of which was hospital room and board per-diem costs.

When applied to this constructed case cost, the variance explanation of the RUG-T18 system dropped precipitously from 55% to 24.2%. The increased variability introduced by multiplying costs by length of stay was the major cause of this drop.

On the basis of these experiments, we are unable to recommend a Medicare patient classification system for case costs. It may be that future research, designed specifically to collect case-based costs may be more successful in identifying such a system, but we are not optimistic that such an effort will be successful.

IV.H Comparison of Medicare Patients with Other Patients on Medicare Units

In collecting data on Medicare patients under the protocols of this study, we automatically collected resource data on all patients on the unit, whether or not they were funded by Medicare. With resource measures to be available, we had these patients assessed as well to develop a complete description. We describe briefly here some of the characteristics of this population.

The basic characteristics of this "non-Medicare" population are shown in Table 31. In comparison with Medicare patients on the same units, the non-Medicare patients were more likely to have been admitted for long-term placement (19%), and had slightly more problems traditionally associated with the long-stay patients, e.g., contractures (see Table 5). On the other hand, compared with the regular nursing home population (in New York State), these patients were more like the Medicare patients in their characteristics, with lower incidences of mental/behavioral problems, feeding needs, etc. (see also Table 7).

Applying the RUG-T18 classification system to these patients, we achieved a 59% variance reduction for total cost and 24.5% for

Table 30
Mean length of stay for RUG-T18 groups

RUG-T18 Group	Length of Stay* Mean	St. Dev.
R1A	31.48	22.47
R1B	38.26	26.03
R2A	35.06	24.17
R2B	42.28	27.31
R3A	29.08	13.19
R3B	43.03	21.77
SA	56.37	42.61
SB	54.09	37.73
CA	23.95	24.71
CB	35.43	25.45
CC	40.62	28.29
MB	53.00	23.69
MC	28.00	20.00
PA	27.17	20.73
PB	27.50	28.29
PC	38.96	22.52
PD	26.86	25.74
Total	37.56	27.85

---

* Performed for patients with reported complete Medicare stays (n=1316)

Table 31
Selected characteristics of non-Medicare SNF patients*

Reason for Placement:		
Temporary Restorative		69%
Hip fracture	17%	
Cerebrovascular Accident	18%	
Temporary care		6%
Long-term placement		19%
Medical Problems:		
Terminally ill		7%
Gait disorder		49%
Upper body contractures		16%
Lower body contractures		17%
Hemi- or paraplegia		18%
Quadriplegia		2%
Dyspnea		9%
Stasis Ulcer		4%
Decubitus - stage 4		4%
Severe pain		10%
Mental Problems:		
Wanders		7%
Verbally abusive		17%
Physically aggressive		9%
Regressive		13%
Hallucinates		3%
Socially withdrawn		29%
Disoriented		39%
Functional (ADL) Independence (including minimal supervision):		
Mobility		22%
Transfer		32%
Eating		66%
Dressing		26%
Bathing		28%
Toileting		30%
Continence:		
Bowel continent		49%
Bladder continent		44%
Indwelling Catheter		22%

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* Assessments of Non-Medicare patients on Medicare units in the study (n=705).

nursing cost (Table 16). The distribution of patients across the RUG-T18 groups (Figure 19) was significantly different than that for either the Medicare (Figure 8) or New York State (Figure 18) populations. Compared with the Medicare population, we see fewer rehabilitation patients and substantially more of all other categories. Compared with the New York State population we see many more of all except the Physical groups. Figure 20 contrasts the Medicare distribution on the top against the non-Medicare distribution downward below the line, where, as before, the RUG-T18 groups have been sorted by increasing case mix indexes from left to right. We see from this figure that the non-Medicare population is substantially more resource-intense than that normally seen in nursing homes. It appears that facilities locate Medicare patients on units with other patients with significant medical problems, although Medicare patients receive more rehabilitation services.

Figure 19

Distribution of Non-Medicare Patients

Under RUG-T18 System

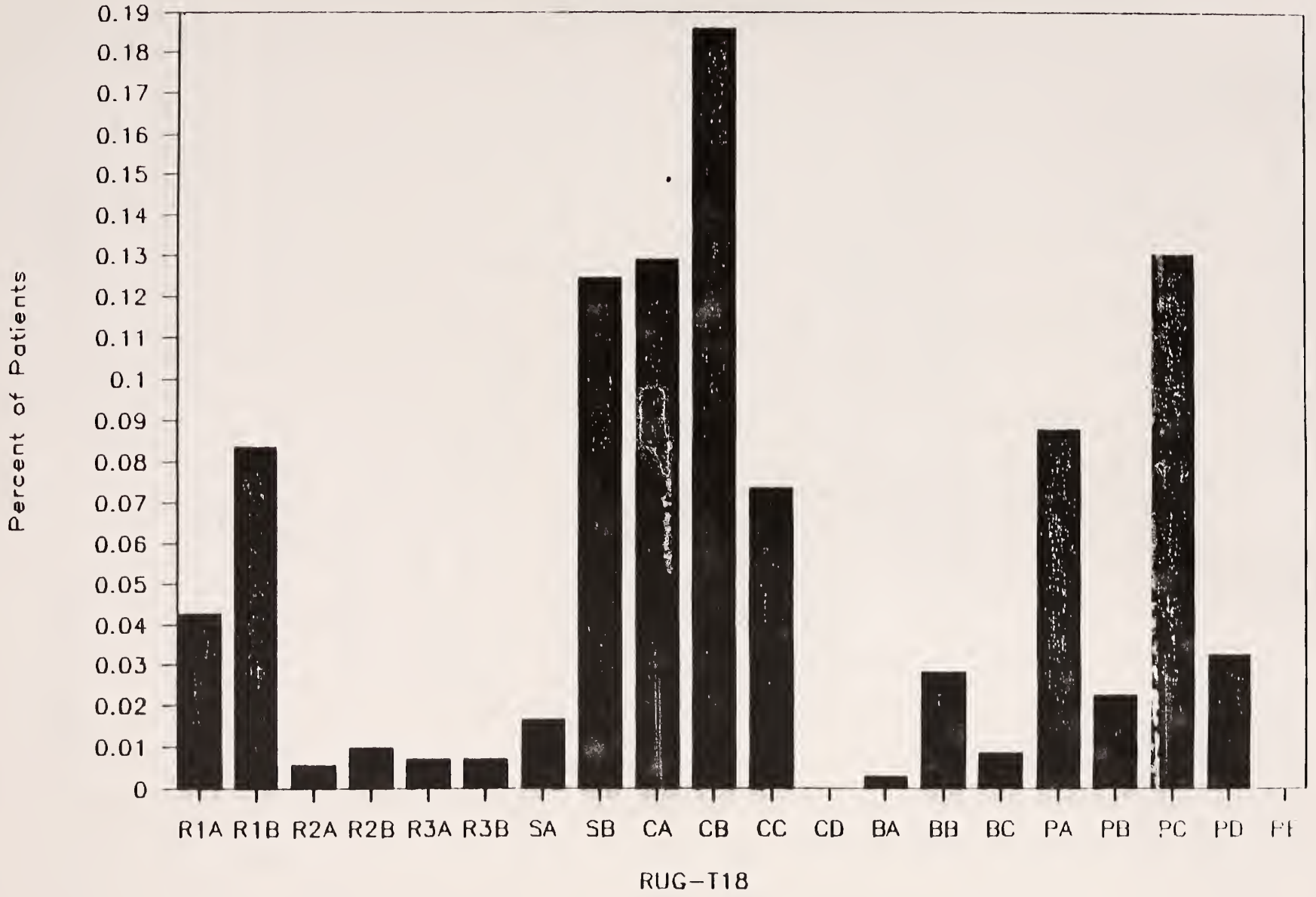
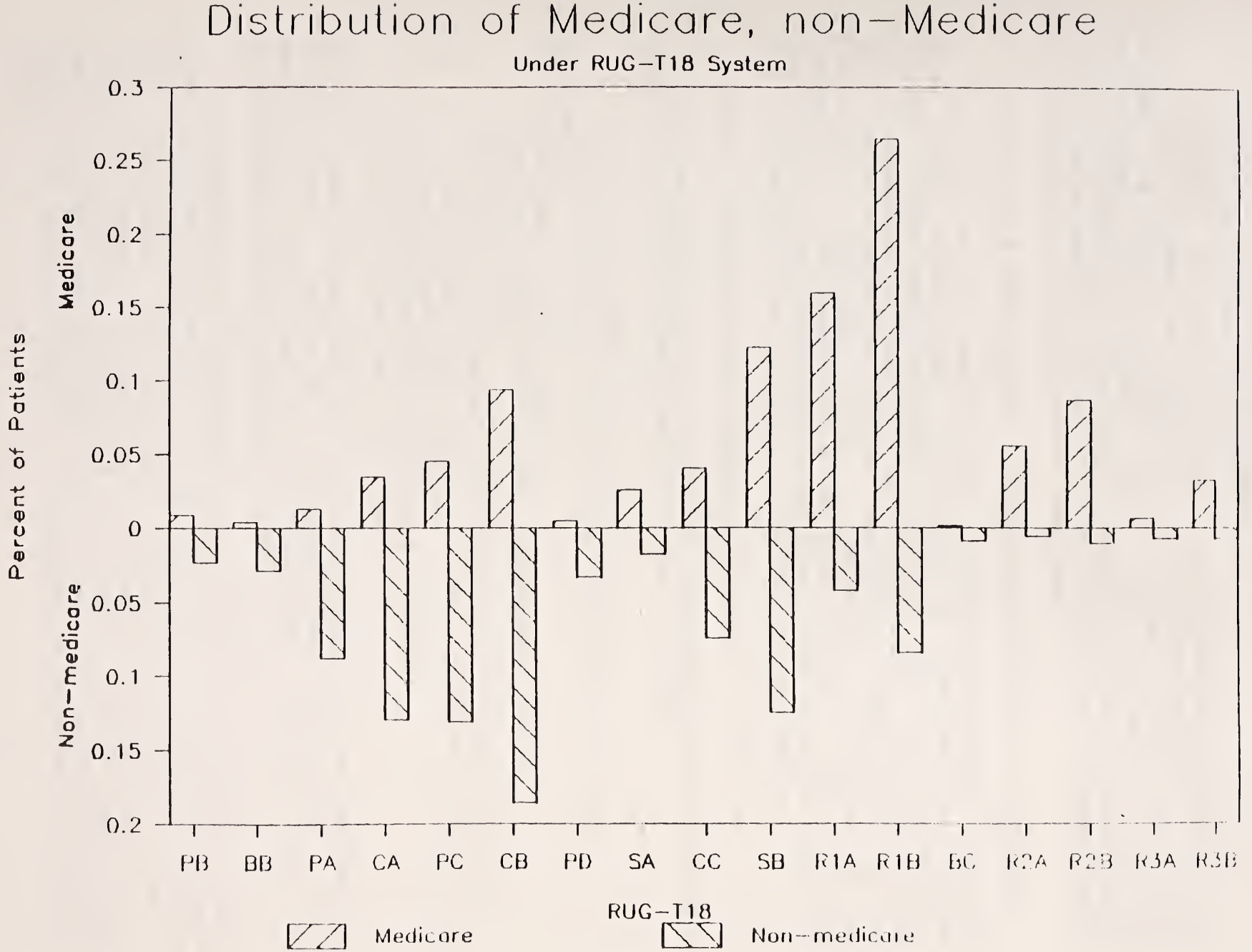


Figure 20


Distribution of Medicare, non-Medicare
Under RUG-T18 System
Percent of Patients
Medicare
Non-medicare
0.3
0.25
0.2
0.15
0.1
0.05
0
0.05
0.1
0.15
0.2
PB
BB
PA
CA
PC
CB
PD
SA
CC
SB
R1A
R1B
BC
R2A
R2B
R3A
R3B
RUG-T18
Medicare
Non-medicare

V. Discussion

The major goal of this study was to develop a patient classification system for Medicare SNF reimbursement. In this process, we gained significant new understanding and several verifications of hypotheses about this population. In this section we summarize these results and discuss their implications. The following sections considers the implication of these results on policy-making for the federal Medicare system.

V.A Choice of a SNF Patient Classification System for Medicare

In deriving a classification system for Medicare, we found three likely candidates. All three of the per-diem systems derived in this study represent effective methods for classifying Medicare patients in Skilled Nursing Facilities. The choice among these three alternative systems represents tradeoffs on several dimensions. In this section we consider the dimensions and tradeoffs in the choice of a per-diem system. There are also tradeoffs involved with consideration of per-diem rather than per-case systems which we consider in the following section.

V.A.1 Objectives and Incentives in Case Mix Systems

Some of the potential objectives for developing and utilizing a case mix system in Medicare SNF payment include:

- Be cost related.
- Recognize/utilize factors which contribute to cost differences.
- Encourage quality care.
- Include incentives for cost containment at the facility level.
- Discourage unnecessary utilization by patients with low care needs and increase access by those patients with the highest care needs.
- Encourage rehabilitation and discharge.
- Be administratively feasible.

Many of these objectives are oriented toward changing the behavior of providers. In a well designed case mix system, changed behavior is encouraged by incorporating incentives into the reimbursement system as opposed to regulation governing behavior.

An incentive is a potential reward that is intended to change a decision maker from neutral (or negative) to favorably disposed toward the desirable end. Incentives can be used to encourage cost containment (the Medicare Prospective Payment System is notable example), to encourage "higher quality" care, and to encourage provider conformance with overall system goals (e.g., reduce the hospital backlog). For an excellent background discussion of the use of incentives, the reader is referred to Willemain (1983).

Often incentives and regulations are seen as two competing strategies, as noted by Schultze (1979):

> Social intervention becomes a race between the ingenuity of the regulatee and the loophole closing of the regulator, with a continuing expansion in the volume of regulations as the outcome... Consistently, where social problems arise because of distorted private incentives, we try to impose a solution without remedying the incentive structure. And equally consistently, the power of that structure defeats us.

In discussing the potential for use of incentives in rate setting, Ruchlin (1979) notes: "The ratesetting process should not only ensure adequate reimbursement, but should also be used as a mechanism to improve both operating efficiency and quality of care/quality of life, and to direct individuals' quest for profits along socially desirable lines." However, as Willemain notes, this view is not shared by all. Vladeck (1980) argues that the realities of program implementation will overwhelm the theoretical attractiveness of incentive payments:

> Champions of incentives over regulation claim that incentives involve "automatic" and "spontaneous" market adjustments while regulation entails red tape and bureaucracy. But the attempt to induce desired performance by reimbursement incentives results in all the complications and distortions attributed to regulation. It is also ineffective... The problem with most (incentive) reimbursement systems is that, to the extent providers fully understand them, they will invariably find a way to beat them, and thus, the "incentives" they are supposed to contain can't possibly work. Besides, it takes time for incentive systems to have effect and they are always being changed.

The authors quoted above concisely focus attention on the current wide gulf between the theoretical promise and the practical problems associated with the general use of incentives. The issue is how to design a case mix system which utilizes the potential for specific case mix features which can either help control negative incentives or which can enhance positive incentives.

Incentives can have impact beyond their rational impact in that they focus attention on a particular approach. The Medicare Prospective Payment System for hospitals is a vivid example in that hospitals are discussing strategic product line planning, cost savings, etc. It is interesting to note that in states with heavy charge based payment, the same opportunities for dramatic enhancement of the operating margin have always existed. The difference is that the attention of the hospital industry has been focused now on the potential for cost savings and revenue enhancement to improve profitability. It is also likely that incentives can be formulated such that the outcome is worth more than we pay for the incentives. Again, the most obvious example is a case mix

pricing system such as Medicare has implemented. This type of system simultaneously controls the rate of inflation and provides incentives for efficient care. Other areas for which incentives have the potential to more than pay for themselves include: (1) acceptance of high care need hospital backlog patients by nursing homes at a rate lower than the marginal hospital rate; (2) partial rehabilitation to move a patient to a less intensive care level; and (3) discharge of patients which will free beds for other patients and, thus, avoid construction of more nursing home beds while decreasing the hospital backlog.

The actual impact of a case mix system depends on two, virtually independent, components: a case mix measurement system and a payment system which utilizes the case mix measurement system. As and example, the Medicaid payment system for nursing homes in New York State is actually two systems: the RUG-II case mix assessment and classification system; and the Modified Pricing System (MPS) (Schneider et al. 1985) which utilizes RUG-II case mix measurement (the MPS is similar to the PPS in concept and incorporates the efficiency incentives inherent in the PPS, but mitigates the "windfall" profit or major losses inherent in a pure pricing system). The RUG-II could be used with many different payment systems, ranging from historical cost-based systems to full pricing systems (as the DRGs are used in the Medicare PPS). The impact on the long-term care (LTC) system and the incentives engendered depend upon the case mix measurement system, the payment system, and the interaction between them.

Under a combination of any of the derived patient classification systems and a payment system similar to the PPS or the RUG-II MPS one can expect several phenomena:

- Incentives to Accept Heavier Care Patients. Under flat rate or cost-based payment systems, a facility is paid the same rate for all patients, regardless of whether their care needs were heavy or light. This presents nursing homes with an incentive to accept lower care patients. With a relatively limited supply of nursing home beds and anticipated increased demand, it is essential that this incentive be reversed, to assure that patients most in need of care gain access to institutional long term care.

- Efficiency Incentives. These systems provide means by which not only individual facilities are encouraged to operate efficiently, but they also offer the potential of more efficient use of the available long-term care resources. As facilities are encouraged to accept heavier care patients, those lighter care patients who could more appropriately be served in community-based care will more often be placed in those settings. The success of this incentive is associated with the accuracy with which the case mix system can predict cost differences between patients.

- **Incentives for Rehabilitation and Discharge.** If the reimbursement systems recognizes and reimburses for the provision of intense rehabilitation to patients with potential for discharge, it offers a strong incentive to encourage the provision of such care. This can result in a more active intervention for patients requiring such care, and an increased discharge rate.

- **Potential Quality of Care Implications.** Under a case mix payment system, there is the potential for a negative incentive; providing inadequate care for a patient is less expensive than providing necessary care, and could lead to deterioration of the patient. This potential provider behavior may have significant impact on which of the alternative Medicare patient classification systems is best suited for use in a payment system (as discussed in the next section). It also is essential to assure that the quality assurance function is operating in a most effective manner. Each system, if implemented, would provide an extensive data base and which could be integrated with a federal quality assurance system, in a similar fashion as integration between the RUG-II and the Patient Care and Services (PaCS) (see, e.g., Balcerzak, 1986) or Sentinel Health Event (Schneider, undated) quality assurance system is being accomplished in New York State. Through such integration, the effectiveness of the quality assurance system can be significantly strengthened by the inclusion of additional outcomes measures.

V.A.2 Criteria and a Recommended Medicare Patient Classification System

We have discussed earlier in Section IV.B.2 the several criteria used to guide the development of a classification system. This earlier discussion sets up the major design point in choosing from the three derived per-diem Medicare systems. Specifically, we recommend the selection of the RUG-T18 system, a modification of the RUG-II system which incorporates therapy counts explicitly. This recommendation is made fully understanding the implications regarding the explicit use of a service variable in the classification system, and, as such, is counter to a more conservative view that a case mix system should only consider patient characteristics. However, there are some specific tradeoffs implicit in such a recommendation:

- **Correspondence with the RUG-II System.** The recommended RUG-T18 system is a adaptation of the RUG-II system, with extensive modifications made to the Rehabilitation groups. Basing the Medicare system on the RUG-II model is advantageous, since the latter system explains resource consumption extremely well for the long stay patients in SNFs and ICFs, including the non-Medicare SNF patients in this five state study, and appears to work well, modified,

for home health care (Foley et al., 1986). Moreover, it was the RUG-based systems that had the highest variance reduction of all the systems evaluated.(See Table 16) Thus, the RUG-II hierarchy and use of ADLs emerge as a robust classification of nursing home patients across many settings and States.

- Explanation of Resource Use. The RUG-T18 system had the best variance reduction of the three systems, followed by RUG-T18A and then RUG-HER. This variance explanation is directly a tradeoff with the involvement of service variables, included in the dependent variable of cost, as independent variables describing types of patients as well. Clearly a substantial portion of the variance reduction of the RUG-T18 and RUG-T18A systems result from what might be considered an incestuous use of variables on "both sides of the equation."

- "You get what you pay for." It follows from the use of therapy counts within the classification, with a threshold time requirement, that Medicare payment would directly relate to what patients actually receive. One can draw a parallel between therapies in LTC and the surgical procedures in the DRGs of acute care. Incorporation of surgical procedures in the DRGs leads to much higher variance explanation; furthermore, surgical procedures had to be incorporated because there were no other direct approaches to measuring the patients need for surgery. We find that while we have made some progress in defining a "therapy" patient in the RUG-HER system, a large number of patients would be misclassified. Approximately 21% of those we would classify in the rehabilitation group actually receive little or no therapy, and 39% of those that receive extensive therapy are not classified as such. The RUG-T18 system, while still not recognizing low levels of rehabilitation services, by construction does not make this type of misclassification error. Furthermore, many facilities in our sample provided little or no occupational or speech therapy, regardless of the patient; others provided extensive PT as well as OT and ST, thereby blurring the distinction between an SNF and a rehabilitation unit in a rehabilitation hospital. A classification and payment system based upon patient characteristics would only dramatically overpay those facilities without the services and penalize those facilities that provided them. This would clearly not be in the best interests of quality care or prudent payment practice.

- Administration and "gaming." Without the explicit recognition of therapies, the issue of "gaming" the system would become a major administrative issue for HCFA and it is likely that rehabilitation service provision would decline, with potential quality implications. Since the Medicare SNF payment system is a relatively small portion of LTC and

a relatively small program for Medicare, it is questionable that return to HCFA would be worth the expense of controlling "therapy gaming."

- **Variation within the industry.** Per-diem costs and therapies provided varied extensively across the sample facilities, regions, and states. Relatively little of the variation in the cost of therapies is explainable strictly employing the characteristics of patients. It is apparent that practice patterns across facilities do not adhere to national, or even state, norms. With such enormous differences in current capabilities, a classification that ignores the actual provision of therapies imposes a norm that would likely reward facilities with the least capacity to meet the needs of the Medicare patients for rehabilitative services. On the other hand, the recommended RUG-T18 classification would lead to a norm that enhances the chances that Medicare patients will receive needed services.

- **Over-provision of rehabilitation services.** The inclusion of explicit rehabilitation categories may lead to patients who don't need them receiving rehabilitation services, thus creating a new opportunity for gaming. Since the current reimbursement system explicitly pays for therapy services, the recommended system will at worst not change these incentives. At best, the RUG-T18 system incorporates the use of therapies in an overall explicit classification that could lead to greater standardization of service availability, control of the price of therapies, and case mix control of the extensive nursing costs in the system. Since it requires that the patient actually receive the service, the facility must incur the cost of the service to receive the price of the service. It follows that their incentive for over-provision of services to patients who do not need the service is limited to the difference between their marginal cost and marginal revenue. Additionally, if patients received extra rehabilitation services, it is likely to be marginally beneficial rather than detrimental: the quality of care implications for over-provision of service are likely to be, at worst, neutral.

We have reported out a total of three systems, as each has certain aspects to recommend them. The RUG-T18A represents a more moderate approach to the problem of using the provision of services as a patient classifier: patients only are assigned into the highest group if they have had a CVA. The RUG-HER system represents a more experimental approach which we feel has potential and which might be useful to other researchers and clinicians in beginning to understand predictive criteria for rehabilitation. It also provides a "lower bound" on the variance explanation that can be achieved by a system which is significantly less dependent upon the use of service variables. However, on balance, we feel

that the RUG-T18, with its superior prediction of resource use, group homogeneity, and incentives is the preferred choice.

The possibility of developing a per-case system at this time seems remote. The ability of patient characteristics to predict either length of stay or constructed case cost is so poor as to make reimbursement somewhat capricious. We discuss in the following section some of the implications of applying a per-diem system in an reimbursement environment currently dominated by a per-case system (PPS).

V.B Policy Implications of Major Results: Development of a Payment System based on RUG-T18 Patient Classification

The design of a payment system includes consideration of the following major aspects:

- Period of payment. Should the payment be based on the day, case, episode, etc.?
- Regulation of utilization. What utilization control mechanism is needed to supplement the payment system?
- Basis for setting the rate. Should the rates be uniform nationally, or set regionally, by peer group, etc.
- Types of costs. Which portion of facility costs should be paid on the basis of case mix, which are unrelated?
- Administration. What are the administrative complexities involved in operating the system?

Each of these aspects is discussed in a following section.

V.B.1 Period of payment

The period of payment is the unit of time to which the payment rate is applied. The usual choices for period of payment include: per-diem, per-case, per-episode, and per time period (e.g., capitation). The basic utilization and pattern of care incentives involved for each of these periods of payment are well known. Per-diem tends to encourage lengthier stays, at potentially less intensive levels of care. Per-case tends to encourage early discharge. Episode systems tend to reward early discharge and fewer admissions. Capitation systems tend to reward less care. Of course, each of the above incentives are attenuated by other aspects of the delivery system (e.g., ethical standards by health care professionals and administrators, quality assurance, utilization review, malpractice).

Two of the alternatives, episode and capitation, clearly are not feasible at this time. The data collected on this project are not configured to consider episodes of care. For example, we have no information regarding the frequency of readmissions for patients within each case mix group. In addition, episode based systems are more complex to derive in that the patient is not "enrolled" to a specific provider. If visit 1 were provided by facility A, and visit 2 by facility B, the tracebacks and mechanisms for splitting the payment would become administratively complex. Capitation systems require an organization that contracts for care of the patient over time. Thus this form of payment is inappropriate for all but those patients enrolled in capitation systems such as the Social Health Maintenance Organizations (S/HMOs). The discussion of these payment methodologies thus falls outside of the purview of this study and analyses of the potentials of these types of payment systems remain areas for future research.

The remaining two approaches, per-diem and per-case, along with a system combining these two, are all conceptually viable alternatives for the Medicare payment system. Since the DRG system is based upon a per-case payment, it is attractive to base Medicare payments to SNFs as well on a per-case basis, even if not directly on the DRGs. The basic strength of this type of symmetry derives from the assumption that the latter days of hospital care and the early days of nursing home care are substitutable used of resources. Consider the case of a "mixed system," where hospital care payment is based upon a per-case system whereas SNF payment is based upon a per-diem system. Then under the previous assumption, hospitals could discharge patients earlier (to incur less hospital cost) and the SNF (which may be part of the same corporation) could care for the patient over a longer period of time. Under the mixed system, the hospital would have decreased costs; the corporation of hospital and nursing home would reap more total payment for equivalent or perhaps less resource use (if nursing home days use less resources than equivalent hospital days). The same incentive for early discharge would exist as well for a combined per-diem and per-case system for SNFs.

The validity of the assumption that hospital days will be traded for nursing home days can be empirical tested. The case-based Medicare Prospective Payment System (PPS) has been in place for several years with a concurrent per-diem SNF payment system. By controlling for demographics, Medicare bed supply, etc., the impact of the PPS on Medicare SNF utilization can be analyzed. Unless hospital days and SNF days are substitutable, no relationship should be observed. Such research would substantially forward the consideration of these alternatives.

A second issue associated with the per-diem/per-case discussion relates to "bundling" the payment for SNF and hospital care. Under such a scenario, hospitals would receive a total payment for the care of a Medicare-eligible patient, including care at both the hospital and a nursing home. All charges for nursing home care would be borne by the hospital from this "bundled" payment. Again, the premise behind bundling is the substitutability of SNF for hospital resources. By bundling the hospital payment with the SNF payment, the tradeoffs for the substitution are made explicit to the discharging hospital. Development of a bundled payment only makes conceptual sense if the SNF payment is per-case based. If the SNF payment is per-diem based, then there is no tradeoff to be made by the discharging hospital - the incentive is to discharge early and provide additional SNF days of care.

The overall issue of bundling includes many factors well beyond the scope of this report. These include the incentives relating to provision or under-provision of needed services; the implications of bundling when the hospital and SNF are not related in a corporate fashion; the roles of hospitals and SNFs in the delivery system; etc. However, the basic issues related to the need for bundling are virtually the same as discussed in the above paragraphs: is SNF utilization currently expanding due to the

mixture of a per-case hospital payment with a per-diem SNF payment?

It follows from this analysis that the choice between per-case (bundled or unbundled) and per-diem payment systems surrounds two issues: (1) is per-case indicated (or needed) due to current findings that SNF care is being substituted for hospital care; and (2) is per-case a technically feasible option? The first question can be empirically tested. In addition, substitutability of nursing home for hospital care is controllable by means other than the payment system, including review of hospital discharges by Peer Review Organizations and of Medicare eligibility for SNF care by Fiscal Intermediaries. However, the overriding issue is the technical one. As was noted in previous sections, attempts to unravel the changes in patterns of care over time and to relate patient characteristics to LOS or per-case costs were basically unsuccessful.

A corollary to the technical findings also argues against a per-case payment. If per-case payment is to be equitable to the provider and the patient, there must be established practice norms of when a patient could/should be discharged. For acute care patients, changes in their status occur rapidly and the medical indicators for discharge are reasonably easy to observe. For the SNF patient, however, the changes in patient condition occur much more slowly; it follows that the identification of an appropriate point in the stay for the patient to be discharged or transferred is much more subjective. For example, the point at which a patient can, or should, be discharged to home depends upon the supports available at home, and the expectations of the patient, including their status before this hospitalization, the patient's expectation for restoration, and so forth.

Another factor arguing against per-case SNF payment relates to the potential for gaming the system, to the detriment of patient care. Since the indicators for discharge are fairly subjective and depend upon a variety of factors not easily measurable, it would be relatively easy for providers to reduce length of stay significantly without going outside the bounds of current practice.

In summary, from a technical perspective, we recommend a per-diem payment system. Variations in the per-case costs were not found to be strongly correlated with measurable patient conditions. The RUG-T18 provides a strong basis for a per-diem payment rate based upon the patient's condition. Nevertheless, from a policy perspective, we have noted some of the issues that could argue for a per-case versus per-diem payment system.

V.B.2 Regulation of utilization

The type of regulation of utilization required in a SNF payment system depends upon the type of adopted. Per-diem systems necessitate review of the eligibility of the admission as well as

the days of care. Per-case systems require a review of the eligibility for the admission. Under either system, some type of review (e.g., PRO, Fiscal Intermediary) is needed. A major outcome of the development of the RUG-T18 system is the potential to target this review. For example, certain of the groups could be designated as usually ineligible for coverage (e.g., the Reduced Physical Functioning groups), while others could be designated as usually eligible (e.g., Rehabilitation groups). The utilization review under a RUG-T18 system could thus be focused on the appropriateness of coverage for patients in the "in between" groups and on the auditing whether or not a facility is gaming the patient assessment used to categorize patients into groups.

A case mix eligibility screen would specify for facilities more concretely who is eligible for Medicare. This could have a variety of effects. One obvious effect is that the criteria for coverage, based upon a patients RUG-T18 category, would be clear, and the Fiscal Intermediary would not have to contend with less paperwork associated with inappropriate applications. On the other hand, by establishing more explicit criteria for eligibility and thereby less prospective risk, more facilities may start offering Medicare services to patients or pattern their care to match those needed to qualify under an eligible RUG-T18 group.

In summary, use of the RUG-T18 would enable HCFA to target the utilization review activities, thus reducing uncertainty to the provider and reducing paper work at the Fiscal Intermediary level. The long range impact of a more explicit statement of Medicare eligibility (i.e., by the use of case mix groups) would depend upon how the utilization review were implemented.

V.B.3 Basis for Setting the Rate

In setting rates, HCFA would need to decide the whether they would be constant across the nation, or differentiated on the bases of geographic area, facility characteristics, or regional input price adjustments. The current PPS uses each of these factors: (1) region was used as during the "phase-in" and urban-rural differences are incorporated in the rate; (2) teaching and non-teaching facilities are paid separately; and (3) regional wage differences are recognized. As we originally proposed, this study does not have consider type of national data base needed to empirically address these choices. Thus the discussion here is limited to presenting the issues.

The data developed in this study show a very strong difference in amount of staffing and care delivered between facilities in each of the five states under study. In addition, the data show a strong variation among facilities in the same state. Similar results were found in the New York State RUG-II study of 52 NYS nursing homes. One approach for responding to this variation is built into the RUG-T18. The "you get what you pay for" approach for the Rehabilitation groups is an explicit

recognition of the differences in rehabilitation patterns of care among facilities (see Section V.A.2).

Beyond the differences in rehabilitation care, there are major differences in nurse staffing. These differences were observed in current Medicare providers who volunteered for this study. The differences among all facilities can be expected to be even larger. The implication is that a payment system that sets a price, based upon the patient's characteristics and the average cost nationally to provide the care for that patient, is likely to provide extensive profits to some facilities, and extensive losses to other facilities. Furthermore, since Medicare is a relatively small portion of a nursing home's revenue, and state-determined Medicaid the largest single portion, the variations in profit are likely to follow state lines.

There are several alternatives to responding to the problem noted above. The approach used in NYS was to develop a Modified Pricing System (MPS). The MPS sets an average price based upon the average statewide cost for a given type of patient. First, the case-mix adjusted mean cost for a facility is determined. Then a corridor is established around the mean price, a value which adjusts for differences in case mix. Thus, a costly facility caring for large numbers of heavy-care patients may have a mean price close to another facility caring for average patients at average cost. Then a corridor for reimbursement is established around this mean price. For example, consider a "20% corridor." Facilities with historic costs (trended forward for inflation) in between 90 and 110% of their mean price would receive in essence these trended costs. A facility whose historical costs was less than 90% of the mean would receive the "base price" (90% of the mean price) while a facility over 110% of the mean would receive the "ceiling price" (110% of the mean price). Over time, the MPS has the same incentives as a pure pricing system. However, its major advantage is that it attenuates the profits and losses resulting from the case mix payment and acknowledges that there is some reasonable variations in practice patterns.

Other approaches could involve setting statewide Medicare prices based upon the average Medicaid rate paid in the state. Other variations on this general theme include peer grouping. Facilities could be peer grouped based upon their nursing staffing levels, or based upon a more complex "tier" system of Medicare facilities based upon programs, staffing, etc.. In addition to facility factors, it is likely that input price adjustments will be necessary to account for regional variations in the labor market basket.

One other approach involved in setting the PPS rate is the use of outliers. Outliers can be determined on one of two bases: high cost per day or long lengths of stay (LOS). Neither of these is likely to be effective for an SNF payment. High cost per day in the hospital is linked to ancillary procedures. In the SNF, high cost per day is linked to nurse staffing needs - a factor

that can not be captured on a patient's bill with the same ease that ancillary charges are captured for the hospital patient. Long LOS is not a factor if a per-diem system is used.

In summary, this study does not have the type of national data base needed to recommend a specific approach to setting the rates. However, the data generated in this study and in the NYS study indicted that setting one national price for a given RUG-T18 group (even with input price adjustments) would lead to major profits in some facilities, and major losses in others. Nevertheless, careful design of a payment system can attenuate these problems.

V.B.4 Types of costs

The types of costs that could be included under case payment include: direct care, indirect (overhead), and capital. During the course of this study, we did not have full cost data from each facility. Instead, we were able to measure direct care costs, adding only other "indirect" time spent by nursing and therapy staffs. Thus, this study does not have a data base that can be used to address these issues. However, our previous study to develop the RUG-II system did have full cost reports from each facility.

The findings from the RUG-II study indicated that a facility's indirect costs and capital costs were not correlated with the case mix of the facility. They were correlated with the size and type of the facility (SNF or ICF, hospital based or free standing). Thus in the RUG-II MPS, the direct care costs are paid through the RUG-II price. The indirect costs are paid through a peer group system using the factors noted above. Capital costs are paid based upon depreciation, leases, and interest.

Administratively, the management of a payment system utilizing separate components for direct and indirect costs is not onerous. The indirect rate for a facility is set once a year and the direct rate is set based upon the type of patient. The payment is simply the sum of the two.

In addition to the lack of correlation between case mix and indirect costs, a second factor argues for the use of case mix to pay for direct care only. Under a case mix system, some upward creep in the case mix measure can be expected. Part of it relates to better coding practices by the facility, part of it involves the acceptance of higher care patients. If the case mix payment controls the entire rate, inflation in case mix inflates both direct and indirect payments. However, even with a higher "actual" case mix, only the facility's direct care cost are strongly affected. Thus using case mix to set the entire rate would provide a bonus to facilities that increase case mix, and a penalty to facilities that decrease case mix.

In summary, the current study does not include the level of overall facility cost data to analyze the impact of setting the rate based upon various categories of costs. However, our previous work in NYS with the RUG-II MPS indicates indirect costs are not correlated with case mix. Thus the NYS MPS sets the direct rate based upon the RUG-II and the indirect rate based upon peer groups.

V.B.5 Administration of A Payment System

The administrative complexity of a case mix system is mainly determined by how an individual patient's case mix category is determined. The other factors include cost reports, cost audits, implementation, recalibration of prices based upon case mix "creep" and penalties for fraud (or incompetence) in assigning patients to case mix groups.

In the ongoing analysis of the RUG-II MPS in NYS, it is evident that the maintenance of the statewide case mix database of 100,000 patients is the major administrative complexity in the system. The other administrative issues noted above are either necessary with or without a case mix system, or are relatively easy to operate. With a case mix system, the data base sets the rate, thus there is an incentive to "game" the assessment. This in turn leads to the need for computerized audits as well as on-site audits to ensure the accuracy of the data. On the other hand, the availability of an accurate and longitudinal picture of patients has enormous potential to assist in understanding system dynamics and to focus quality of care audits.

If the case mix payment system includes bundling the hospital rate with the nursing home rate, then additional administrative measures are likely to be necessary. These include a stronger review to ensure that needed services in the SNF are provided, as well as an analysis of the ways in which the bundled rate is apportioned to the care the patient receives.

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